19th SOSORT International Congress of the

Society on Scoliosis Orthopaedic and Rehabilitation Treatment

SOSORT 2024

Boston, USA, May 1-4, 2024

Conference program and

Book of Abstracts

Dear SOSORT Attendees,

On behalf of the Board of Directors, the Event and Educational committees, it is my great pleasure to extend a warm welcome to every one of you to the 19th SOSORT International Congress taking place in the vibrant city of Boston, Massachusetts.

As we gather here for this prestigious scientific meeting, we are united by our shared passion for advancing knowledge, fostering collaboration, and pushing the boundaries of scientific discovery. Boston, with its rich history and thriving scientific community, provides the perfect backdrop for our collective pursuit of excellence.

Throughout the course of this event, you will have the opportunity to engage with leading experts in your and related professions, participate in insightful discussions, and explore the latest advancements in the non-operative management of individuals with scoliosis and other spinal conditions. Our carefully curated program aims to inspire and stimulate intellectual exchange, fostering new ideas and partnerships that will undoubtedly contribute to the progress of our respective fields.

In addition to the exceptional scientific content, we encourage you to take full advantage of the unique cultural experiences that Boston has to offer. From historical landmarks such as the Freedom Trail to the world-class museums, parks, and culinary delights. Boston is sure to leave you with unforgettable memories.

As we embark on this journey of knowledge and discovery together, I am confident that the 19th SOSORT International Congress will be a resounding success, thanks to the collective expertise and enthusiasm that each of you brings to this gathering.

SOSORT is you, so thank you for being a part of this distinguished event. May your time in Boston be both intellectually rewarding and personally enriching.

James H. Wynne, CPO
SOSORT President

SOSORT 2024 Scientific Committee

The Scientific Committee is dedicated to ensuring the quality of the research communicated in SOSORT. The Scientific Committee also periodically conducts consensus exercises and guidelines update initiatives.
scientific.committee@sosort.org

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1st May 2024

	Program
07:00 - 08:00	**Breakfast & Registration** Grand Ballroom Foyer, West Tower, Level 2
08:00 - 08:05	**Introduction : Tony Betts, PT** Grand Ballroom, West Tower, Level 2 Pre-course Lectures
08:05 - 10:45	**Pre-course Session 1: Medical Assessment and Treatment** Grand Ballroom, West Tower, Level 2 M. Timothy Hresko Pre-course Lectures **08:05 - 08:10** **Opening Remarks : M. Thimothy Hresko M.D.** **08:10 - 08:30** **AI - What Does It Mean and What Is the Future in the Assessment of Scoliosis? Edmond Lou, PhD** **08:30 - 08:50** **Topographical 3D Imaging: Roger Widman, M.D.** **08:50 - 09:10** **Assessment of Curve Severity Using the Light Detection Ranging (LiDAR) Technology: John Vorhies, M.D.** **09:10 - 09:30** **US and Cobb Angle Assessement: Edmond Lou, Ph.D.** **09:30 - 09:50** **Discussion** **09:50 - 10:10**

	Vertebral Body Tethering Past and Present Treatment Protocols and State of the Art Techniques: Juan Rodriguez-Olaverri, MD, PhD
	10:10 - 10:30
	Spinal Muscular Atrophy Assessment and Treatment Advancements : Brian Snyder, MD, PhD
	10:30 - 10:45
	Discussion - Q&A : M. Timothy Hresko, MD and Craig Birch, MD
10:45 - 11:15	**Coffee Break** Grand Ballroom Foyer, West Tower, Level 2 Coffee Break
11:15 - 12:40	**Pre-Course Session 2: Bracing** Grand Ballroom, West Tower, Level 2 Craig Birch, M.D., Luke Stikeleather, CPO Pre-course Lectures **11:15 - 11:20** **Opening Remarks : Luke Stikeleather, CPO** **11:20 - 11:40** **3D Printing Bracing - Types and Materials : Andreas Wuersching, CPO** **11:40 - 12:00** **Brace Monitors Past to Current Types and Future Visions : John Tunney, CPO** **12:00 - 12:20** **Biomechanical Modeling and Predictive Analytics to Optimize Brace Treatment of AIS : Carl Eric Aubin, PhD, P.Eng.** **12:20 - 12:40** **Discussion Q&A : Luke Stikeleather, CPO and Martin Matthews, CO, MPhil**
12:40 - 13:40	**Lunch** Grand Ballroom Foyer, West Tower, Level 2 Lunch

13:40 - 15:55	**Pre-Course Session 3 : Physiotherapeutic Scoliosis-Specific Exercises (PSSE)**
	Grand Ballroom, West Tower, Level 2
	Amy Sbihli MPT, DPT., Sanja Schreiber, B.Sc., M.Sc., Ph.D.
	Pre-course Lectures
	13:40 - 13:45
	Introduction : Amy Sbihli, MPT, DPT.
	13:45 - 14:05
	Motion Analysis - Monitoring and Measuring Scoliosis Relevant Outcomes : Nachi Chockalingam, PhD
	14:05 - 14:25
	Standardization of Digital Photography Technique in Scoliosis Assessment : Dariusz Czaprowski, PhD, PT
	14:25 - 14:45
	The Emerging Use of EMG for Biofeedback in Clinical Care : Tony Betts, PT
	14:45 - 15:05
	Telehealth PSSE - Opportunities and Cchallenges : Alessandra Negrini, PT
	15:05 - 15:25
	Discussion - Q&A Amy Sbihli, MPT, DPT and Sanja Schreiber, BSc., M.Sc., Ph.D,
	15:25 - 15:45
	Principles and Practice of Clinical Research : Felipe Fregni, MD, M.P.H., PhD and Alma Sanchez M.D.
	15:45 - 15:55
	Discussion
15:55 - 16:00	**Closing Comments: Tony Betts, PT**
	Grand Ballroom, West Tower, Level 2
	Pre-course Lectures
16:00 - 18:00	

18:00 - 20:00	**Welcome Reception** Longfellow, West Tower, Level 1

2nd May 2024 Scientific Presentations

	Program
08:00 - 10:00	**Session 1: Bracing** Grand Ballroom, West Tower, Level 2 Mr Angelo Gabriele Aulisa, Mr Pavel Cerny Oral presentations **08:00 - 08:03** **Introduction** **08:03 - 08:10 [O1]** **ENHANCING SCOLIOSIS BRACE COMFORT: THE KEY ROLE OF ORTHOTISTS** Megan Glahn Castille, Kayli Schwantz **08:10 - 08:17 [O2]** **PERSONAL AND CLINICAL DETERMINANTS OF BRACE WEARING TIME IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS.** Giulia Fregna, Sara Rossi Raccagni, Alessandra Negrini, Fabio Zaina, Stefano Negrini **08:17 - 08:24 [O3]** **INFLUENCE OF SPECIFIC INTERVENTIONS ON BRACING COMPLIANCE IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS. A SYSTEMATIC REVIEW OF THE LITERATURE INCLUDING SENSORS' MONITORING** Claudio Cordani, Lia Malisano, Francesca Febbo, Giorgia Giranio, Matteo Johann Del Furia, Sabrina Donzelli, Stefano Negrini **08:24 - 08:31 [O4]** **CAN EARLY BRACE WEAR COMPLIANCE OF PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS PREDICT FUTURE WEAR?** Alexa P. Bosco, BA, M. Timothy Hresko, MD, Christine B. Sieberg, PhD, EdM, MA, Gabriel S. Linden, BA, Shanika De Silva, PhD, Grant D. Hogue, MD, Craig M. Birch, MD, Daniel J. Hedequist, MD, Lawrence I. Karlin, MD, John B. Emans, MD **08:31 - 08:39** **Discussion**

08:39 - 08:46 [O5]

IMMEDIATE EFFECT OF THE 3D BRACE ON COBB ANGLE REDUCTION IN PATIENTS WITH JUVENILE AND ADOLESCENT IDIOPATHIC SCOLIOSIS

Isis Navarro, Aleksandro Pontes

08:46 - 08:53 [O6]

CORONAL DEFORMITY ANGULAR RATIO MAY SERVE AS A VALUABLE PARAMETER TO PREDICT IN-BRACE CORRECTION IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS

Zifang Huang, Junlin Yang, Liangyi Liang

08:53 - 09:00 [O7]

FACTORS THAT INFLUENCE IN-BRACE CORRECTION IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS

Zifang Huang, Junlin Yang, liangyi Liang

09:00 - 09:07 [O8]

IN-BRACE CORRECTION DURING PROVIDENCE NIGHTTIME BRACE TREATMENT FOR IDIOPATHIC SCOLIOSIS PREDICTS CURVE PROGRESSION

Karina Zapata, Kara Davis, Chan-Hee Jo, Daniel Sucato, Megan Johnson

09:07 - 09:15

Discussion

09:15 - 09:22 [O9]

Does Apical Vertebra Location Influence the Final Outcome of Conservative Treatment for Idiopathic Scoliosis?

Angelo Gabriele Aulisa, Martina Marsiolo, Valeria Calogero, Marco Giordano, Francesco Falciglia

09:22 - 09:29 [O10]

BRACING AT LATER GROWTH STAGE FOR SEVERE SCOLIOSIS > 40O CAN BE AN ALTERNATIVE FOR PATIENTS REFUSING SURGICAL TREATMENT&NBSP;

Nikos Karavidas

09:29 - 09:36 [O11]

EFFECTIVENESS OF NIGHTTIME BRACING IN BOYS WITH IDIOPATHIC SCOLIOSIS

Karina Zapata, James McGinley, Kara Davis, Chan-Hee Johnson, Dan Sucato, Megan Johnson

09:36 - 09:43 [O12]

THE CLINICAL OUTCOMES OF LUMBOSACRAL ORTHOSIS FOR ADOLESCENT IDIOPATHIC

SCOLIOSIS PATIENTS WITH MAJOR THORACOLUMBAR/LUMBAR CURVES

Junlin Yang, Tianyuan Zhang, Lin Sha, Zifang Huang, Wenyuan Sui, Jingfan Yang, Zifang Zhang, Yaolong Deng

09:43 - 09:53

Discussion

09:53 - 10:00

Group Picture

10:00 - 10:30	

10:30 - 11:30	**Session 2: Quality of Life and Patient-Reported Outcomes** Grand Ballroom, West Tower, Level 2 Mrs Sunciça Bulat Wursching, Mr Stefano Negrini Oral presentations **10:30 - 10:37 [O13]** **CAN CURRENTLY USED QUESTIONNAIRES LIKE ODI (AND SRS-22) DISCRIMINATE PATIENTS WITH SCOLIOSIS IN A POPULATION WITH CHRONIC BACK PAIN?** Fabio Zaina, Carmelo Pulici, Stefano Negrini **10:37 - 10:44 [O14]** **BACK PAIN PREVALENCE AND PROMIS SCORES IN CHILDREN WITH HYPERKYPHOSIS COMPARED TO IDIOPATHIC SCOLIOSIS** Karina Zapata, Eliza Lovrich, Chan-Hee Jo, Brandon Ramo **10:44 - 10:51 [O15]** **RESPONSIVENESS OF PROMIS METRICS WITH THE EOSQ24 IN EARLY ONSET SCOLIOSIS** Karina Zapata, Chan-Hee Jo, Brandon Ramo, James McGinley **10:51 - 10:59** **Discussion** **10:59 - 11:06 [O16]** **PROMIS AND ODI TOOLS: CLINICALLY USEFUL PREDICTORS OF ABNORMAL MRIs IN**

PEDIATRIC BACK PAIN?

Devan Devkumar, Karina Zapata, Chan-Hee Jo, Brandon Ramo

11:06 - 11:13 [O17]

IMPACT OF SURGICAL TREATMENT FOR ADOLESCENT IDIOPATHIC SCOLIOSIS ON MATERNAL AND OBSTETRIC OUTCOMES: A META-ANALYSIS

Eduardo Hevia, Jesús Burgos, Ignacio Sanpera, Vicente García, Gonzalo Mariscal, Carlos Barrios

11:13 - 11:20 [O18]

IT IS ALL ABOUT PERSPECTIVES – LEVEL OF AGREEMENT BETWEEN THE PATIENT AND THEIR PARENT AND PHYSICIAN IN PERCEPTION OF SPINAL APPEARANCE IN ADOLESCENT IDIOPATHIC SCOLIOSIS

D.G. van de Fliert, M.L. van Hooff, M. de Kleuver, P. Bisseling, J.P.H.J. Rutges, T.P.C. Schlösser, D.H.R. Kempen

11:20 - 11:27

Discussion

11:30 - 12:00	**Guest Lecture: Dr. M. Timothy Hresko M.D. Department of Orthopaedic Surgery at Harvard Medical School and Children's Hospital in Boston, Massachusetts.** Grand Ballroom, West Tower, Level 2 Mr James Wynne Chair BETTER THAN GOOD: SPINAL GUIDED GROWTH As an orthopedic surgeon who treats patients with non-operative and operative methods , I am aware of the parallel history of scoliosis treatment. I will do a brief review of the history of scoliosis treatment and point out he developments over time. In the past, treatment has centered on stopping progress of the structural spine disorder to a surgical level. However, perhaps we can do better than that goal. I will present our present research into brace compliance and your future goals.
12:00 - 13:00	
13:00 - 15:00	**Session 3: Exercise** Grand Ballroom, West Tower, Level 2

Mr Michele Romano, Ms Sanja Schreiber

Oral presentations

13:00 - 13:07 [O19]

EFFECTS OF SPECIFIC EXERCISE THERAPY ON ADOLESCENT PATIENTS WITH IDIOPATHIC SCOLIOSIS: A PROSPECTIVE CONTROLLED COHORT STUDY

Zifang Huang, Junlin Yang, Xiaoling Xuan

13:07 - 13:14 [O20]

EFFECT OF SPECIFIC EXERCISE THERAPY IN THE TREATMENT OF SKELETALLY IMMATURE IDIOPATHIC SCOLIOSIS

Zifang Huang, Junlin Yang, Xiaoling Xuan

13:14 - 13:21 [O21]

A RETROSPECTIVE STUDY OF PHYSIOTHERAPY SCOLIOSIS SPECIFIC EXERCISES WITH AND WITHOUT BRACING

Rachel Tombeno, Kathryn Williams, James Wynne

13:21 - 13:28 [O78]

PHYSIOTHERAPY SCOLIOSIS SPECIFIC EXERCISE IMPROVES TRUNCAL SHIFT IN IDIOPATHIC SCOLIOSIS - A COMPLIANCE FOLLOW-UP

Charles Impey, Georgina Frere, Christine Pilcher, Erika Maude, Zion Hwang, Jason Bernard, Bisola Ajayi, Darren Lui

13:28 - 13:35

Discussion

13:35 - 13:42 [O23]

BEST PRACTICE FITNESS EXERCISE GUIDELINES FOR ADULTS WITH SPINAL DISORDERS: A DELPHI SURVEY

Lise Stolze, Hagit Berdishevsky, Meredith Cohen, Jean Claude De Mauroy

13:42 - 13:49 [O24]

IMPROVED EFFECTIVENESS OF SCOLIOSIS SPECIFIC PHYSIOTHERAPY BY INCREASING PARENTS' PARTICIPATION IN CONSERVATIVE TREATMENT

Marianna Białek, Ewelina Białek-Kucharska, Justyna Pękala, Andrzej M'hango, Tomasz Kotwicki

13:49 - 13:56 [O25]

INDIVIDUALS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS PARTICIPATING IN PHYSICAL

THERAPY SCOLIOSIS-SPECIFIC EXERCISE DEMONSTRATE IMPROVEMENT IN RIB CAGE MOBILITY AND HEALTH-RELATED QUALITY OF LIFE

Michelle Engberg, Kellen Feeney, Todd Warner, Sara Morgan, Walter Truong

13:56 - 14:03 [O26]

REPORTING EXERCISE COMPLIANCE IN STUDIES INVESTIGATING PHYSIOTHERAPEUTIC SCOLIOSIS SPECIFIC EXERCISE IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS: A SCOPING REVIEW

Azharuddin Fazalbhoy, Jeb McAviney, Rosemary Marchese

14:03 - 14:10

Discussion

14:10 - 14:17 [O27]

INFLUENCE OF SCHROTH BEST PRACTICE THERAPY ON VENTILATORY FUNCTION IN ADOLESCENT IDIOPATHIC SCOLIOSIS: RANDOMIZED CONTROLLED STUDY DESIGN

Mahmoud Aly, Alaa Hegazy, Akram Sayed, Awny Rahmy, Ali Shauosh, Mohamed Negm

14:17 - 14:24 [O28]

SCHROTH CURVE TYPES PRESENT DIFFERENT BASELINE VALUES BUT SIMILAR CHANGES IN PATIENT-REPORTED OUTCOMES – A SECONDARY DATA ANALYSIS OF THE SCHROTH EXERCISE TRIAL FOR ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS).

Eric Parent, Sanja Schreiber, Sarah Southon Hryniuk, Kathleen Shearer, Graham Murray

14:24 - 14:31 [O29]

IS SCHROTH METHOD EFFECTIVE TO IMPROVE THE COBB ANGLE, QUALITY OF LIFE AND TRUNK ROTATION ANGLE IN ADOLESCENT IDIOPATHIC SCOLIOSIS? A SYSTEMATIC REVIEW AND META-ANALYSIS.

Garikoitz Aristegui Racero, Andoni Carrasco Uribarren, Sara Cabanillas Barea, Sandra Jiménez del Barrio, Silvia Perez Guillen, Pilar Pardos Aguilella, Borislav Chongov, Luis Ceballos Laita

14:31 - 14:38 [O30]

EFFECTIVENESS OF RIGO CONCEPT PSSE IN ADULT SCOLIOSIS

Amy Sbihli, Amaia Molinuevo

14:38 - 14:45

Discussion

14:45 - 14:52 [O31]

EFFECTS OF SCOLIOSIS-SPECIFIC EXERCISE IN ELECTROMYOGRAPHIC ACTIVITY OF

PARAVERTEBRAL MUSCLES OF PARTICIPANTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS: AN ASSESSOR-BLINDED RANDOMIZED CONTROL TRIAL

Yunli Fan, Eric HK Yeung, Zhuoman Xu, Jason PY Cheung, Michael KT To, Kenneth MC Cheung

14:52 - 14:59 [O32]

S4D SPECIFIC EXERCISES COMBINED WITH THE S4D BRACE IN DIFFERENT RISSER BONE MATURITY STAGES FOR THE TREATMENT OF ADOLESCENT IDIOPATHIC SCOLIOSIS: A RETROSPECTIVE COHORT STUDY

Milene Eloise Callegari Ferreira, Rodrigo Mantelatto Andrade, Carlos Eduardo Gonçalves Barsotti, Ariane Verttú Schmidt, Raphael Reis Almeida, Leandro Guenka, Thomas Nogueira Burke, Fabiana Terra Cunha, Ana Paula Ribeiro, Helton Luiz Aparecido Defino

14:59 - 15:00

Discussion

15:00 - 15:30	

15:30 - 17:00	**Session 4: Etiology and Pathogenesis**

Grand Ballroom, West Tower, Level 2

Mr Jean-Claude De Mauroy, Mr Tomasz Kotwicki

Oral presentations

15:30 - 15:37 [O33]

IMPLICATIONS OF PEDIATRIC CHEST WALL SURGERIES ON THE RISK OF DEVELOPMENT OF SCOLIOSIS

Rachel White CPO, Michael Ginzburg Psy.D., MA., MS., CO, LMFT

15:37 - 15:44 [O34]

RETROSPECTIVE ANALYSIS OF THE CO-OCCURRENCE OF SCOLIOSIS AND INFANTILE CHEST WALL SURGERIES

Michael Ginzburg, PsyD, CO, Rachel White, CPO

15:44 - 15:51 [O35]

CONVEXITY ORIENTATION OF SINGLE SCOLIOSIS CURVES. ARE THEY AS WE HAVE ALWAYS BEEN TAUGHT? VERIFICATION OF 4470 CURVES

Michele Romano

15:51 - 15:58

Discussion

15:58 - 16:05 [O36]

DEVELOPING AND VALIDATING A MULTIVARIABLE PROGNOSTIC MODEL FOR RISK OF CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS: A PROSPECTIVE COHORT ANALYSIS

Marlene Dufvenberg, Anastasios Charalampidis, Elias Diarbakerli, Birgitta Öberg, Hans Tropp, Anna Aspberg Ahl, Daphne Wezenberg, Henrik Hedevik, Hans Möller, Paul Gerdhem, Allan Abbott

16:05 - 16:12 [O37]

LOW BONE MINERAL DENSITY IS A POSSIBLE INDICATOR TO THE SEVERITY OF ADOLESCENT IDIOPATHIC SCOLIOSIS

Junlin Yang, Tianyuan Zhang, Zifang Huang, Wenyuan Sui, Zifang Zhang, Wenqing Wei, Yaolong Deng, Xiexiang Shao, Jingfan Yang

16:12 - 16:19 [O38]

CORRELATION BETWEEN GENERAL JOINT MOBILITY (BEIGHTON SCORE) AND THE SPECIFIC CURVE MOBILITY (STIFFINESS SCOLOSIS TEST) IN PATIENTS WITH IDIOPATHIC SCOLIOSIS

Isis Navarro, Ingrid dos Santos

16:19 - 16:26

Discussion

16:26 - 16:33 [O39]

MAXIMAL AND ASYMMETRICAL SUBMAXIMAL PARASPINAL MUSCLE ACTIVATION IN ADOLESCENT IDIOPATHIC SCOLIOSIS DURING SIMPLE BACK EXTENSION TASKS.

Phoebe Ng, Phoebe Duncombe, Andrew Claus, Maree Izatt, Robert Labrom, Wolbert van den Hoorn, Kylie Tucker

16:33 - 16:40 [O40]

SUSPECTED HIGH PREVALENCE AND GENDER DIFFERENCE OF SCOLIOSIS CURVES WITH THE APEX AT T12.

Michele Romano

16:40 - 16:47

Discussion

3rd May 2024 Scientific Presentations

	Program
08:00 - 10:00	**Session 5: SOSORT Award Nominees** Grand Ballroom, West Tower, Level 2 Mr Patrick Knott, Mr Luke Stikeleather Oral presentations **08:00 - 08:03** **Introduction** **08:03 - 08:12 [O41]** **VALIDITY AND ACCURACY OF AUTOMATIC COBB ANGLE MEASUREMENT ON 3D SPINAL ULTRASONOGRAPHS FOR CHILDREN WITH ADOLESCENT IDIOPATHIC SCOLIOSIS** Jason Wong, Edmond Lou, Marek Reformat, Eric Parent **08:12 - 08:21 [O42]** **VALIDITY OF A FAST AUTOMATED 3D SPINE RECONSTRUCTION MEASUREMENTS FOR BIPLANAR RADIOGRAPHS** Weiying Chen, Mahdieh Khodaei, Marek Reformat, Edmond Lou **08:21 - 08:30 [O43]** **SURFACE TOPOGRAPHY DEMONSTRATES GRADUAL IMPROVEMENT IN SPINAL RANGE OF MOTION IN ALL THREE PLANES FOLLOWING POSTERIOR SPINAL FUSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS** Akshitha Adhiyaman, Gabriel Linden, Colson Zucker, Jenna Wisch, Ankush Thakur, Howard Hillstrom, Benjamin Grossier, Douglas Mintz, Matthew Cunningham, Ram Haddas, Timothy Hresko, John Blanco, Joe Nguyen, Jessica Heyer, Roger Widmann **08:30 - 08:38** **Discussion** **08:38 - 08:47 [O44]** **CAN SURFACE TOPOGRAPHY RELIABLY DETERMINE THE RIGO CLASSIFICATION SYSTEM?** Natalie Schmidt, Adam Thiessen, Marissa Selthafner, Xue-Cheng Liu **08:47 - 08:56 [O45]**

THE TEST-RETEST RELIABILITY OF FRONTAL, SAGITTAL, AND TRANSVERSE SPINAL MEASUREMENTS OF ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS OBTAINED USING 3D ULTRASOUND IMAGING

Brianna Fehr, Eric Parent, Janie Pollard, Aislinn Ganci, Edmond Lou

08:56 - 09:01

Discussion

09:01 - 09:10 [O46]

QUANTIFYING FULL SPINE PARASPINAL MUSCLE VOLUME, INTRAMUSCULAR FAT AND FAT-FREE MUSCLE ASYMMETRY IN ADOLESCENT IDIOPATHIC SCOLIOSIS

Phoebe Duncombe, Taylor Dick, Phoebe Ng, Maree Izatt, Robert Labrom, Kylie Tucker

09:10 - 09:19 [O47]

ASYMMETRY IN THE ONSET OF PARASPINAL MUSCLES ACTIVITY DURING RAPID ARM MOVEMENTS DIFFERS IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS COMPARED TO THOSE WITH A SYMMETRICAL SPINE

Kylie Tucker, Frederique Dupuis, Phoebe Ng, Phoebe Duncombe, Maree Izatt, Robert Labrom, Wolbert van den Hoorn

09:19 - 09:28 [O48]

EFFECTIVENESS OF BRACE TREATMENT IN ADOLESCENTS IDIOPATHIC SCOLIOSIS (AIS) PATIENTS WITH CURVES BETWEEN 40° AND 60° COBB

Junlin Yang, Zifang Huang, Xiaoling Xuan

09:28 - 09:36

Discussion

09:36 - 09:45 [O49]

COMBINED EFFECT OF COMT AND MTHFR GENETIC VARIANTS ON ADOLESCENT IDIOPATHIC SCOLIOSIS PROGRESSION

Jessica Wright, Adrijana Kekic, Jana Kay Lacanlale, Ann Vincent, Mark Morningstar

09:45 - 09:54 [O50]

THE MORPHOLOGICAL DISCREPANCY OF NEUROMUSCULAR JUNCTIONS FROM BILATERAL PARASPINAL MUSCLES IN ADOLESCENT IDIOPATHIC SCOLIOSIS: A QUANTITATIVE IMMUNOFLUORESCENCE ASSAY

Tianyuan Zhang, Junlin Yang, Wenyuan Sui, Xiexiang Shao, Zifang Huang, Jingfan Yang, Yaolong Deng, Zifang Zhang

	09:54 - 10:00 **Discussion**
10:00 - 10:30	
10:30 - 11:10	**Session 6: Pre- and Post-op Care / Remote Assessment and Care** Grand Ballroom, West Tower, Level 2 Ms Hagit Berdishevsky, Mr Tomasz Kotwicki Oral presentations **10:30 - 10:37 [O51]** **HOSPITAL OUTCOMES IN THE POSTOPERATIVE PERIOD OF NEUROMUSCULAR SCOLIOSIS: RELATIONSHIP BETWEEN CLINICAL EVENTS, EARLY MOBILITY AND LENGTH OF STAY.** Marcia Mendoza, Andrea Mafra, Adne Santos, Clara Godoy **10:37 - 10:44 [O52]** **FIVE DAYS OF SCOLIOSIS-SPECIFIC EXERCISES IMPROVE PREOPERATIVE SPINAL FLEXIBILITY IN PATIENTS WITH RIGID ADOLESCENT IDIOPATHIC SCOLIOSIS** Yunli Fan, Michael KT To, Zhuoman Xu, Kenneth MC Cheung, Jason PY Cheung, Eric HK Yeung **10:44 - 10:50** **Discussion** **10:50 - 10:57 [O53]** **CONCURRENT VALIDITY AND DIAGNOSTIC ACCURACY OF THE DIPA-S© EHEALTH CAPTURE AND ANALYSIS SYSTEM FOR THE ASSESSMENT OF PATIENTS WITH SCOLIOSIS THROUGH TELECONSULTATION** Isis Navarro, Eric Parent, Jefferson Loss, Cláudia Candotti **10:57 [O54]** **ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) TREATMENT, COMBINING IN-PERSON AND ONLINE SESSIONS, CAN INCREASE COMPLIANCE, ENHANCE EFFECTIVENESS, AND IMPROVE MONITORING OF PATIENTS WITH TRANSPORTATION BARRIERS TO HEALTHCARE ACCESS** Nikos Karavidas **Discussion**

11:10 - 11:35	**SCOLIOSIS RESEARCH SOCIETY Presidential Lecture: Dr Marinus de Kleuver M.D., Ph.D. Head of the Department of Orthopedic Surgery at Radboud University Medical Center, Netherlands.** Grand Ballroom, West Tower, Level 2 Mr James Wynne Guest lecture PULMONARY SYMPTOMS IN ADOLESCENT AND ADULT PATIENTS WITH A SPINAL DEFORMITY Pulmonary symptoms such as shortness of breath with exertion and reduced exercise tolerance are commonly experienced in patients with spinal deformity (adolescents and adults). In a recent patient survey patients described their symptoms as "breathlessness" or "fatigue"/"fatigue due to limited endurance". Daily functioning of patients was limited due to the pulmonary problems and patients reported worsening of symptoms with increased fatigue. In a recent systematic review by Van Kempen et al. (2022), that included 8,723 patients with AIS, it was concluded that pulmonary function test (PFT) decline correlated with curve severity as measured by the radiographic thoracic Cobb angles. As yet, these clinically relevant pulmonary symptoms are not routinely monitored and may have health implications later in the patient's life as pulmonary function gradually deteriorates with age and the deterioration is correlated with curve severity. Pulmonary function tests (PFTs) have been used in an attempt to quantify pulmonary symptoms. However, a discrepancy exists between these measurement outcomes and symptoms experienced by patients, diminishing their clinical value in routine care for these patients. To evaluate pulmonary symptoms from a patient's perspective, adequate patient-reported outcome measures (PROMs) should be used, but do not yet exist. This presentation will discuss current work that is being performed on measuring pulmonary function and exercise (in)tolerance, based on structured patient interviews, testing patients using smart vests with sensors and the to development of a patient reported outcome measure (PROM).
11:35 - 12:00	**SOSORT PRESIDENTIAL LECTURE: James Wynne, CPO, FAAOP, Vice-President, Director of Education, Resident Director, Boston Orthotics and Prosthetics, Boston, Massachusetts** Grand Ballroom, West Tower, Level 2 Ms Sabrina Donzelli Guest lecture

12:00 - 13:00	
13:00 - 13:30	**Guest Lecture: Dr Aina J. Danielsson M.D., Ph.D. Department of Orthopaedics, Sahlgrenska University Hospital, Gothenburg, Sweden.** Grand Ballroom, West Tower, Level 2 Mr Elias Diarbakerli Guest lecture WHAT HAPPENS AS THE YEARS GO BY? RESULTS FROM MULTIPLE LONG TERM OUTCOME STUDIES AFTER TREATMENT OF IDIOPATHIC SCOLIOSIS BEFORE MATURITY The presentation will look into the results ofthree long term outcome studies of idiopathic scoliosis patients with both juvenile and adolescent onset. Outcome after conservative treatment will be presented and reflected against the outcome after operative treatment. Radiographic appearance, pulmonary function and different aspects of quality of life and psychological well-being will be discussed.Results from an ongoing long-term outcome study focusing on morbidity and mortality in currently middle-aged individuals with juvenile idiopathic scoliosis treated before maturity will also be presented and discussed in the light of the outcome if no treatment is given.Hopefully, the knowledge from these studies might help to support the patients and their parents through an often very tough period of treatment.
13:30 - 14:20	**Session 7: Exercise and Bracing** Grand Ballroom, West Tower, Level 2 Mr Garikoitz Aristegui, Mr Larry Cohen Oral presentations **13:30 - 13:37 [O55]** **TAILBONE'S ACTIVE GRAVITATIONAL CONTROL: A QUANTITATIVE ANALYSIS OF THE COMBINED EFFECT OF THE JI METHOD AND PVC SOFT BALL ON SCOLIOSIS CORRECTION** Nanyoung Ji **13:37 - 13:44 [O56]** **INTENSIVE BRACING MANAGEMENT COMBINED WITH PHYSIOTHERAPEUTIC SCOLIOSIS-SPECIFIC EXERCISDES FOR ADOLESCENT IDIOPATHIC SCOLIOSIS PATIENTS WITH 40-60° MAJOR CURVES WHO REFUSED SURGERY.** Junlin Yang, Tianyuan Zhang, Zifang Huang, Wenyuan Sui, Wenqing Wei, Xiexiang Shao, Yaolong Deng, Jingfan Yang, Zifang Zhang

13:44 - 13:51 [O57]

A Comparison of Bracing to Casting for Infantile Idiopathic Scoliosis

Sydney Lee, Stephanie Wong, Daniel Hedequist, Lawrence Karlin, Craig Birch, Grant Hogue, Shanika De Silva, M Timothy Hresko

13:51 - 13:59

Discussion

13:59 - 14:06 [O58]

AUTOMATED DESIGN OF BRACES FOR THE TREATMENT OF ADOLESCENT IDIOPATHIC SCOLIOSIS USING A SHAPE OPTIMIZATION ALGORITHM

Aymeric Guy, Maxence Coulombe, Hubert Labelle, Soraya Barchi, Carl-Eric Aubin

14:06 - 14:13 [O59]

IMMEDIATE EFFICACY OF BRACES GENERATED AUTOMATICALLY BY A SHAPE OPTIMIZATION ALGORITHM TO TREAT ADOLESCENT IDIOPATHIC SCOLIOSIS: A RANDOMIZED CONTROLLED TRIAL.

Maxence Coulombe, Aymeric Guy, Anton Manitiu, Philippe Poirier, Julie Joncas, Olivier Chémaly, Félix Brassard, Stefan Parent, Hubert Labelle, Carl-Éric Aubin

14:13 - 14:20

Discussion

14:20 - 14:30	**Invitation to SOSORT 2025: Suncica Bulat Würsching M.D. Host**
	Grand Ballroom, West Tower, Level 2
	Mr Jeb McAviney
	General Assembly Meeting

4th May 2024 Scientific Presentations

	Program
08:30 - 10:00	**Session 8: Imaging and Assessment,** Grand Ballroom, West Tower, Level 2 Mr Dariusz Czaprowski, Ms Isis Navarro Oral presentations **08:30 - 08:37 [O60]** **THE RELIABILITY OF THE C7-SACRAL LASER LINE MEASUREMENT AS A CLINICAL MEASURE OF SCOLIOSIS** Beth Terranova, PT, Jennie Harary, SPT, Mistral Hay, SPT, Jaya Rachwani, PT PhD, Nicki Silberman, PT PhD **08:37 - 08:44 [O61]** **CAN CLINICAL EVALUATION TOOLS PREDICT CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS? A CORRELATIONAL STUDY&NBSP;** Nikos Karavidas, Lukasz Stolinski, Yavuz Yakut, Firas Wahbeh, Dariusz Czaprowski **08:44 - 08:51 [O62]** **NARROWING INDICATIONS FOR BRACING IN AIS USING BRAIST-CALC** Lori Dolan, Stuart Weinstein **08:51 - 08:58 [O63]** **A METHODOLOGICAL REVIEW OF MODELS PREDICTING CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS** Lori Dolan, Jennifer Deberg, Daniel Bartelt **08:58 - 09:06** **Discussion** **09:06 - 09:13 [O64]** **NORMATIVE DATA FOR RADIOGRAPHIC SAGITTAL PARAMETERS IN ASYMPTOMATIC POPULATION FROM CHILDHOOD TO ADULTHOOD: A SYSTEMATIC SEARCH AND REVIEW** Claudio Cordani, Sabrina Donzelli, Giulia Fregna, Bruno Leonelli, Serena Quaggio, Fabio Zaina, Alessandra Negrini, Stefano Negrini

09:13 - 09:20 [O65]

DISTRIBUTION OF CURVE FLEXIBILITY IN IDIOPATHIC SCOLIOSIS - A DESCRIPTIVE STUDY

Simon Blanchard, Matan Malka, Ritt Givens, Michael Vitale, Benjamin Roye

09:20 - 09:27 [O66]

COMPARISON OF THE KEY RADIOLOGICAL CRITERIA WITH SURFACE TOPOGRAPHIC CRITERIA IN THE RIGO CLASSIFICATION

Natalie Schmidt, Adam Thiessen, Marissa Selthafner, Xue-Cheng Liu

09:27 - 09:34 [O67]

INTER-RATER AND INTRA-RATER RELIABILITY OF A NEW ADOLESCENT IDIOPATHIC SCOLIOSIS CURVE TYPE CLASSIFICATION, BASED ON CLINICAL, RADIOLOGICAL, AND PROGNOSTIC CRITERIA

Nikos Karavidas, Yavuz Yakut, Merve Karatel, Burcin Serinturk, Larisa Iacob, Georgiana Cojocaru, Sarah Mohamed Ali, Silvio Selfo

09:34 - 09:42

Discussion

09:42 - 09:49 [O68]

DEVELOPMENT AND VALIDATION OF DEEP LEARNING ALGORITHMS FOR SCOLIOSIS SCREENING USING BACK IMAGES

Junlin Yang, Zifang Huang

09:49 - 09:56 [O69]

ADVANCED 3D TORSO SCAN ANALYSIS FOR COBB ANGLE PREDICTION IN AIS: REGRESSION-FOCUSED CNN WITH REPEATED STRATIFIED CROSS-VALIDATION.

Mostafa Hassan, Jose Maria Gonzalez, Nada Mohamed, Qipei Mei, Lindsey Westover

09:56 - 10:00

Discussion

10:00 - 10:30	
10:30 -	**Session 9: Ultrasound Imaging, Bracing and Exercise** Grand Ballroom, West Tower, Level 2

12:02

Mr Nikos Karavidas, Mr Fabio Zaina

Oral presentations

10:30 - 10:37 [O70]

COMPARISONS OF INTER-APICAL DISTANCE AND CORONAL BALANCE AMONG STANDING POSITIONS IN HEALTHY PARTICIPANTS AND ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS USING 3D ULTRASOUND IMAGING

Aislinn Ganci, Janie Pollard, Brianna Fehr, Edmond Lou, Eric Parent

10:37 - 10:44 [O71]

THE EFFECT OF ARM POSITIONS USED DURING RADIOGRAPHY ON SPINAL ALIGNMENT PARAMETERS ASSESSED BY 3D ULTRASOUND IMAGING IN ADOLESCENTS WITH AND WITHOUT IDIOPATHIC SCOLIOSIS WITH TWO DIFFERENT CURVE TYPES

Brianna Fehr, Eric Parent, Sarah Bruha, Aislinn Ganci, Kathleen Shearer, Miran Qazizada, Ana Vucenovic, Edmond Lou

10:44 - 10:51 [O72]

USING B-MODE ULTRASOUND TO EVALUATE THE RISSER GRADE FOR DETERMINING SKELETAL MATURITY IN FEMALE ADOLESCENTS

Phoebe Duncombe, Phoebe Ng, Maree Izatt, Greg Duncombe, Kylie Tucker

10:51 - 10:58 [O73]

THE USE OF ULTRASONOGRAPHY TO MEASURE THE FLEXIBILITY OF SCOLIOSIS IN CORONAL BENDING

Patryk Wiliński, Piotr Janusz, Tomasz Kotwicki

10:58 - 11:06

Discussion

11:06 - 11:13 [O74]

IDENTIFYING PREDICTORS OF BRACE TREATMENT OUTCOMES USING ARTIFICIAL INTELLIGENCE IN CHILDREN WITH IDIOPATHIC SCOLIOSIS

Mahdieh Khodaei, Eric C. Parent, Mengxuan Liu, Carl Ganzert, Andrea Mendoza, Edmond Lou

11:13 - 11:20 [O75]

HIGHER RIGO-CHENEAU WEAR-TIME IS ASSOCIATED WITH CURVE REDUCTION AND LOW RISK OF PROGRESSION TO SURGERY

Ritt Givens, Matan Malka, Kevin Lu, Michael Vitale, Benjamin Roye

11:20 - 11:27 [O76]

EFFECTIVENESS OF SCHROTH PHYSICAL THERAPY PROGRAM ON CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) WITH VARYING BRACE INTERVENTIONS- A RETROSPECTIVE STUDY

Ashley Barnas, Mark Lee, Lauren Kline, Megan Chamis

11:27 - 11:34

Discussion

11:34 - 11:41 [O77]

DEVELOPMENT OF A VISUO-PROPRIOCEPTIVE STIMULATION DEVICE FOR ADOLESCENT IDIOPATHIC SCOLIOSIS REHABILITATION: RESEARCH PROTOCOL

Robert Maurice Etoumbe, Cyril Duclos, Carole Fortin

11:41 - 11:48 [O22]

THE EFFECTS OF SHORT- AND LONG-TERM SPINAL BRACE USE WITH AND WITHOUT EXERCISE ON SPINE, BALANCE, AND GAIT IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS

Guilherme Erdmann da Silveira, Rodrigo Mantelatto Andrade, Gean Gustavo Guilhermino, Ariane Verttú Schmidt, Ana Paula Ribeiro

11:48 - 12:05 [O79]

MILD AND MODERATE ADOLESCENT IDIOPATHIC SCOLIOSIS: RIGO CONCEPT INTERDISCIPLINARY APPROACH

Garikoitz Aristegui, Amaia Molinuevo, Borislav Chongov

12:05 - 12:10

Discussion

Poster presentation Program

	Date	Title	Authors
May 2 2024 Morning Coffee Break and Lunch Time			
Poster 1	May 2, 2024	THE RELATIONSHIP BETWEEN COBB ANGLE AND INFLAMMATION PARAMETERS Ä°N PATIENTS DIAGNOSED WÄ°TH SCOLIOSIS	AYÃ‡A URAN ÅžAN, ZÃœLAL YEÅžÄ°LLÄ°, ESRA ÃœLGEN KIRATLIOÄžLU, SELVÄ°NAZ KIZILIRMAK, A.KENAN TAN
Poster 2	May 2, 2024	DECREASED ESTROGEN RECEPTOR 1 (ESR1) IN MUSCLE STEM/PROGENITOR CELLS AT CONCAVE SIDE CONTRIBUTES TO ADOLESCENT IDIOPATHIC SCOLIOSIS	Junlin Yang, Xiexiang Shao, Tianyuan Zhang, Wenyuan Sui, Jingfan Yang, Yaolong Deng, Zifang Huang, Zifang Zhang
Poster 3	May 2, 2024	FUNCTIONAL SCOLIOSIS: THE RELATIONSHIP WITH VERTEBRAL ROTATION, SACRAL SHELF OBLIQUITY AND LIMB LENGTH INEQUALITY AT 12 MONTHS OF FOLLOW-UP.	Martina Marsiolo, Francesco Falciglia, marco Giordano, Diletta Bandinelli, Angelo Gabriele Aulisa
Poster 4	May 2, 2024	CORRELATION ANALYSIS OF PARAVERTEBRAL MUSCLE ACTIVATION AND 3D PARAMETERS IN APEX VERTEBRA IN ADOLESCENT IDIOPATHIC SCOLIOSIS: A PRELIMINARY STUDY OF MAJOR THORACIC CURVATURE	Xiaohui Zhang, Bagen Liao
Poster 5	May 2, 2024	CURRENT KNOWLEDGE OF CHIROPRACTIC STUDENTS ON ADOLESCENT IDIOPATHIC SCOLIOSIS IN THE USA	Xiaohua He
Poster 6	May 2, 2024	POSTURAL HABITS AND LIFESTYLE FACTORS ASSOCIATED WITH ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) IN CHINA: RESULTS FROM A BIG CASEâ€"CONTROL STUDY.	Junlin Yang, Zifang Huang, Xiaoling Xuan
Poster 7	May 2, 2024	THE CHARACTERISTICS OF SCOLIOSIS PATIENTS PRESENTING TO A PRIVATE CLINICAL NETWORK IN AUSTRALIA	Rosemary Marchese, Benjamin Brown, Tamara Pooke, Jeb McAviney
Poster 8	May 2, 2024	ACCURACY OF SCREENING FOR ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS): A PROSPECTIVE SCREENING METHODS STUDY	Junlin Yang, Zifang Huang, Xiaoling Xuan
Poster 9	May 2, 2024	EFFECT OF ADOLESCENT IDIOPATHIC SCOLIOSIS ON MOBILITY AND TRUNK OSCILLATION	Rodrigo Mantelatto Andrade, Raphael Reis Almeida, Guilherme Auler Brodt, Millene Eloise Callegari, Carlos Eduardo GonÃ§al Barsotti, Mariana Leite, FlÃ¡via Cordeiro de Medeiros, Ana Paula Ribeiro
Poster 10	May 2, 2024	KNOWLEDGE OF PHYSIOTHERAPISTS FROM POLAND AND THE CZECH REPUBLIC ON THE DIAGNOSIS AND TREATMENT OF IDIOPATHIC SCOLIOSIS	Dariusz Czaprowski, Piotr WÃ³jcik, Pavlu Dagmar, Paulina Ewertowska, Mateusz Kozinoga
Poster 11	May 2, 2024	EARLY RESULTS OF A VIRTUAL SCOLIOSIS BRACING MULTIDISCIPLINARY MEETING	Laura Smith, Rosina Howatson, Anh Ngyuen, Tesfaldet Kurban, Charlie Taylor, Bisola Ajayi, Tim Bishop, Jason Bernard, Darren Lui
Poster 12	May 2, 2024	PROFILE OF SPORTS ACTIVITY PRACTICE IN PATIENTS WITH SCOLIOSIS	Isis Navarro, Marina Frantz, ClÃ¡udia Candotti
Poster 13	May 2, 2024	SCREENING FOR SPINE AND FEET IN CHILDREN FROM 7 TO 13 YEARS OF AGE IN BULGARIA	Borislav Chongov, Lyubomira Sazdova

Poster presentation Program

Poster 14	May 2, 2024	DIAGNOSTIC ACCURACY OF CLINICAL SCREENING TOOLS FOR GENERALIZED JOINT HYPERMOBILITY AND INHERITED CONNECTIVE TISSUE DISORDERS IN PATIENTS WITH SCOLIOSIS - A SYSTEMATIC LITERATURE REVIEW	Kathryn Bacigalupo, Nara Yoon, Eric Parent
Poster 15	May 2, 2024	TETHERED CORD SYNDROME IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS; COURSE AND TREATMENT, A PATIENTâ€™S EXPERIENCE	Hiba Aswad

May 2 2024 Lunch Time and Afternoon Coffee Break

Poster 16	May 2, 2024	PHYSIOTHERAPY SCOLIOSIS SPECIFIC EXERCISES AND THREE-DIMENSIONAL BRACING IMPROVE A SEVERE ADOLESCENT IDIOPATHIC SCOLIOSIS CURVATURE, A CASE REPORT.	Corinne Reynolds
Poster 17	May 2, 2024	STAND-UP-PADDLING AS PART OF PHYSIOTHERAPEUTIC TREATMENT AND/OR AS A LEISURE ACTIVITY FOR CONSERVATIVELY TREATED PATIENTS WITH IDIOPATHIC SCOLIOSIS. A QUALITATIVE STUDY.	Julia Kalchschmiedt
Poster 18	May 2, 2024	REDUCTION OF PAIN AND IMPROVEMENT OF FUNCTIONALITY IN PATIENTS WITH DEGENERATIVE SCOLIOSIS, USING PATTERN SPECIFIC SCOLIOSIS REHABILITATION - PROSPECTIVE COHORT STUDY	Lisa Hjorth Elliott, Pernille WinslÃ¸v Wied
Poster 19	May 2, 2024	DEVELOPMENT AND VALIDATION OF A NEW QUESTIONNAIRE OF PHYSIOTHERAPEUTIC SPECIFIC EXERCISES OF SCOLIOSIS- QPSSE	Theodoros B. Grivas, Dimitra Dadakaridou, Stavroula A. Fokidi, Alexandros Kastrinis, Melpomeni Kosti, Constantinos Mihas, Marianna Oikonomaki, Evangelos Theodosopoulos, Artemis Margarita Griva
Poster 20	May 2, 2024	EFFECTIVENESS OF SCROTH PHYSICAL THERAPY PROGRAM ON CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) WITH AND WITHOUT BRACING INTERVENTION- A RETROSPECTIVE STUDY	Ashley Barnas, Mark Lee, Lauren Kline
Poster 21	May 2, 2024	EFFECT OF PHYSIOTHERAPEUTIC SCOLIOSIS-SPECIFIC EXERCISES ON ACTIVATION OF PARAVERTEBRAL AND RESPIRATORY MUSCLES IN AIS PATIENTS WITH RIGO A TYPE	Bagen Liao, Xiaohui Zhang
Poster 22	May 2, 2024	MODIFIED PSSE POST SPINAL FUSION FOR AN INDIVIDUAL WITH SMA III AND AIS: A TAILORED APPROACH	Rebekah Wallach, Karlie Gross, Cara Kanner, Rafael Rodriguez-Torres, Jacqueline Montes
Poster 23	May 2, 2024	EFFECT OF SEAS APPROACH ON FEMALE IDIOPATHIC SCOLIOSIS PATIENT IN 20S ON TRUNK APPEARANCE ASSESSMENT: A CASE REPORT	Dohyun Park, Hankyu Park
Poster 24	May 2, 2024	SPORTS SPECIFIC SCOLIOSIS CORRECTION EXERCISE PROGRAM BASED ON SEAS APPROACH FOR ADOLESCENT IDIOPATHIC SCOLIOSIS PATIENTS PARTICIPATING IN SPORTS ACTIVITIES.	Kangmin Lee, Sungyoung Yoon
Poster 25	May 2, 2024	NON-SURGICAL REDUCTION IN FULL SPINE SAGITTAL BALANCE AND IMPROVED SENSORIMOTOR CONTROL IN AN OLDER ADULT WITH SPINAL DEFORMITY: A CBPÂ® CASE REPORT	Paul Oakley, William Gage, Deed Harrison, George Mochizuki

Poster presentation Program

Poster 26	May 2, 2024	IMPROVED POSTURAL CONTROL IN A PATIENT HAVING ADULT SPINAL DEFORMITY AND PREVIOUS THORACO-LUMBAR SCOLIOSIS SURGERY: A CBP® CASE REPORT	Paul Oakley, Jason Haas, Deed Harrison
Poster 27	May 2, 2024	PATIENT DIGITAL TWIN AND PERFORMANCE CAPTURE SYSTEM FOR SCOLIOSIS PHYSIOTHERAPY	Zhiqing Cheng, Wenye He, Charles Cheng
Poster 28	May 2, 2024	EFFECT OF AN INTERVENTION PROGRAM WITH SPECIFIC S4D EXERCISES THROUGH TRADITIONAL PHYSIOTHERAPY AND TELEREHABILITATION IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS	Rodrigo Mantelatto Andrade, Carlos Eduardo Barsotti, Ariane Verttú Schmidt, Alexandre Penna Torini, Marina Pegoraro Baroni, Bruno T Saragiotto, Ana Paula Ribeiro
Poster 29	May 2, 2024	MATERIAL SENSITIVITY OF PATIENT-SPECIFIC FINITE ELEMENT MODELS IN THE BRACE TREATMENT OF SCOLIOSIS	Junlin Yang, Wenqing Wei, Tianyuan Zhang, Zifang Huang, Wenyuan Sui, Yaolong Deng, Jingfan Yang
Poster 30	May 2, 2024	PREPARE: PERSONALIZED REHABILITATION VIA NOVEL AI PATIENT STRATIFICATION STRATEGIES - THE CASE FOR IDIOPATHIC SCOLIOSIS DURING GROWTH	Carlotte Kiekens, Alberto Negrini, Irene Ferrario, Stefano Negrini

May 3 2024, Morning Coffee Break and Lunch Time

Poster 31	May 3, 2024	INVESTIGATION OF THE EFFECT OF SPINAL ORTHOSIS ON THE SENSE OF TOUCH AND BALANCE IN INDIVIDUALS WITH ADOLESCENT IDIOPATHIC SCOLIOS WITH CURVATION IN THE LUMBAL REGION	BAŞAK Ä°ÅžÄ‡Ä°OÄžLU, Sena Ã–ZDEMÄ°R GÃ–RGÃœ
Poster 32	May 3, 2024	A MULTIMODAL NON-SURGICAL APPROACH TO SEVERE ADOLESCENT IDIOPATHIC SCOLIOSIS: A CASE SERIES	Anthony Nalda, Rosemary Marchese, Tamara Pooke, Jeb McAviney
Poster 33	May 3, 2024	CASE SERIES REPORT OF ATYPICAL LUMBAR SCHEUERMANN€™S DISEASE TREATED WITH BRACES AND PHYSIOTHERAPEUTIC SPECIFIC EXERCISES	Greta Jurenaite, Giulia Fregna, Fabio Zaina, Stefano Negrini
Poster 34	May 3, 2024	SUCCESSFUL TREATMENT OF DEGENERATIVE ADULT SCOLIOSIS USING A UNIQUE 3D OVER-CORRECTIVE BRACE - A CASE REPORT WITH 6 YEAR FOLLOW UP	Michael Underhill, Jeb McAviney
Poster 35	May 3, 2024	ENHANCING SCOLIOSIS BRACING: INVESTIGATING THE IMPACT OF IN-BRACE CORRECTION EXCEEDING 100% ON SKELETAL OUTCOMES, COMFORT, AND COMPLIANCE	Anna Courtney, Sam Walmsley, Jack Choong, Jason Bernard, Timothy Bishop, Darren Lui
Poster 36	May 3, 2024	COMBINING 3D DESIGN WITH THE CERVICAL THORACIC ORTHOSIS (CTO) IN THE TREATMENT OF ANTECOLLIS AND PISA SYNDROME IN PARKINSON DISEASE: A CASE REPORT	Peeraya Ruthiraphong, Narudon Batasuk
Poster 37	May 3, 2024	3D-PRINTED SPINAL ORTHOSIS FOR ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) IN A LOW-TO-MIDDLE-INCOME COUNTRY; CASE REPORT.	Peeraya Ruthiraphong, Narudon Batasuk
Poster 38	May 3, 2024	EARLY WEANING OF THE 3D BRACE IN A PATIENT WITH JUVENILE IDIOPATHIC SCOLIOSIS DURING 5 YEARS OF TREATMENT â€" A CASE STUDY	Isis Navarro, Leonardo Grandi
Poster 39	May 3, 2024	HOW WILL I SEE MY BODY AFTER SURGERY? - COMPARISON OF THE TRUNK APPEARANCE PERCEPTION SCALE BEFORE AND AFTER SURGICAL TREATMENT OF ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS	Patryk Wiliński, Katarzyna Politarczyk, Tomasz Kotwicki

Poster 40	May 3, 2024	PHYSIOTHERAPEUTIC SCOLIOSIS SPECIFIC EXERCISE AND BRACING FOR SECONDARY CURVE AFTER LUMBAR VERTEBRAL BODY TETHERING: A CASE REPORT	Trella Allen, John Tunney

May 3 2024 Lunch Time and Afternoon Coffee Break

Poster 41	May 3, 2024	IMAGING STUDY OF COCCYGEAL MORPHOLOGY IN ADOLESCENT IDIOPATHIC SCOLIOSIS	xiaoming ying, haoyang zhang, Xin Ye
Poster 42	May 3, 2024	STRATIFIED PREDICTIVE MODELING FOR PROGRESSION OF IDIOPATHIC SCOLIOSIS	Milan Patel, Xue-Cheng Liu, Kai Yang, Channing Tassone, Benjamin Escott, John Thometz
Poster 43	May 3, 2024	LESSONS LEARNED ON TRUNK NEUROPHYSIOLOGY AND MOTOR CONTROL FROM ADOLESCENT IDIOPATHIC SCOLIOSIS. A SCOPING REVIEW	Claudio Cordani, Giulia Fregna, Matteo Johann Del Furia, Fabio Zaina, Stefano Negrini
Poster 44	May 3, 2024	RELIABILITY OF THE BIOMECHANICAL ASSESSMENT OF THE SAGITTAL THORACIC SPINE ON RADIOGRAPHS USED IN CLINICAL PRACTICE: A SYSTEMATIC REVIEW OF THE LITERATURE.	Lightstone Douglas, Joseph Betz, Jason Haas, Paul Oakley, Deed Harrison, Ibrahim Muostafa
Poster 45	May 3, 2024	NOVEL SURFACE TOPOGRAPHIC ASSESSMENT OF LUNG VOLUME IN PEDIATRIC SPINAL DEFORMITY PATIENTS	Jessica Heyer, Jenna Wisch, Kiranpreet Nagra, Ankush Thakur, Howard Hillstrom, Benjamin Groisser, Colson zucker, Matthew Cunningham, M. Timothy Hresko, Ram Haddas, John Blanco, Mary Di Maio, Roger Widmann
Poster 46	May 3, 2024	NON-STEROIDAL ANTI-INFLAMMATORY DRUG USE AND SERIOUS ADVERSE GASTROINTESTINAL OUTCOMES IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS WHO HAVE A CLINICALLY ACTIONABLE GENE-DRUG INTERACTION VIA A CYP2C9 REDUCED METABOLIZER PHENOTYPE	Jana Kay Lacanlale, Adrijana Kekic, Razan El Melik, Eric Matey, Jessica Wright
Poster 47	May 3, 2024	MEASUREMENTS OF THE ANGLE OF THE TRUNK ROTATION IN PATIENTS WITH IDIOPATHIC SCOLIOSIS USING A BUNELL SCOLIOMETER, A MOBILE PHONE WITH AN ADAPTIVE OVERLAY AND USING THE TECHNIQUE OF ALIGNING THE PHONE WITH THUMBS - REPEATABILITY AND RELIABILITY OF MEASUREMENT	Karolina SÅ‚awatycka, MikoÅ‚aj PuchaÅ‚a, Filip Rochowiak, Patryk WiliÅ„ski, Katarzyna Politarczyk, Tomasz Kotwicki, Piotr Janusz
Poster 48	May 3, 2024	POSTURAL CONTROL IN ADULT SPINAL DEFORMITY: A SYSTEMATIC REVIEW OF THE LITERATURE	Paul Oakley, Cecilia Power, William Gage, George Mochizuki
Poster 49	May 3, 2024	SCOLIOSIS, SPINE FUSION, MENTAL HEALTH, BODY IMAGE, AND RESILIENCE â€" PSYCHOLOGICAL COUNSELING AND THERAPEUTIC ALLIANCE	Tamie Gangloff
Poster 50	May 3, 2024	SRS-22r RESULTS IN YOUNG ADULT FEMALES PREVIOUSLY CONSERVATIVELY TREATED FOR IDIOPATHIC SCOLIOSIS	Marianna BiaÅ‚ek, Ewelina BiaÅ‚ek-Kucharska, Tomasz Kotwicki
Poster 51	May 3, 2024	DEVELOPMENT OF A PSYCHOEDUCATIONAL SUPPORT GROUP PROGRAM FOR NEWLY BRACED SCOLIOSIS PATIENTS - A PILOT STUDY	Megan Glahn Castille, Gabriel Breaux, Kelly Moton, Danielle Porter, Whitney Howie, Annisa Ahmed, Robert McLaughlin
Poster 52	May 3, 2024	CHARACTERISTICS OF PAIN IN ADULT SPINAL DEFORMITY	Georgina Frere, Christine Pilcher, Charles Impey, Erika Maude, Zion Hwang, Jason Bernard, Bisola Ajayi, Darren Lui

Poster 53	May 3, 2024	RANGE OF MOTION ANALYSIS AND OUTCOME MEASURES FOLLOWING POSTERIOR DYNAMIC DEFORMITY CORRECTION (PDDC) SURGERY AND REHABILITATION	Michael Albert, Ann Smith, Michael Breneman, Megan Reissman
Poster 54	May 3, 2024	ISYQOL-PL QUALITY OF LIFE OF ADOLESCENTS TREATED WITH A BRACE FOR IDIOPATHIC SCOLIOSIS	Katarzyna MarszaÅ,, Mateusz Kozinoga, Katarzyna Politarczyk, Krzysztof Korbel, Tomasz Kotwicki
Poster 55	May 3, 2024	IDENTIFYING THE PROGNOSTIC FACTORS OF QUALITY-OF-LIFE TREATMENT OUTCOMES FOR BRACE-ONLY OR SPECIFIC EXERCISE-ONLY TREATMENTS FOR ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS	Mahdieh Khodaei, Eric C. Parent, Jason Wong, Veena Logithasan, Andrea Mendoza, Carl Ganzert, Edmond Lou
Poster 56	May 3, 2024	IDENTIFYING PROGNOSTIC FACTORS OF PATIENT RELATED OUTCOMES MEASUREMENTS IN QUALITY-OF-LIFE FOR AN INTEGRATED BRACE AND SPECIFIC EXERCISE TREATMENT FOR ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS	Mahdieh Khodaei, Eric C. Parent, Jason Wong, Brianna Fehr, Tehzeeb Sayed, Andrea Mendoza, Carl Ganzert, Edmond Lou
Poster 57	May 3, 2024	THE PSYCHOLOGICAL APPROACH OF THE JI METHOD: THE IMPORTANCE OF ENGAGEMENT AND STABILITY IN TREATING SCOLIOSIS"	Nanyoung Ji

SOSORT 2024 Guest Speakers

Dr. Aina Danielsson, M.D., Ph.D.

Bio:

Dr. Aina Danielsson is associate professor in orthopedics at the University of Gothenburg and works clinically as Senior Consultant with pediatric orthopedic patients at Sahlgrenska University Hospital, Gothenburg, Sweden.

Her research interest has mainly focused on long-term outcome studies after treatment performed before maturity in individuals with idiopathic scoliosis, where radiographic appearance, pulmonary function and quality of life have been the main focus.

Other research studies have included patients with congenital orthopedic conditions where, in particular, the patient's own experience after treatment has formed an important perspective. She has participated in the translation and validation of a number of outcome tools in Swedish, regarding both scoliosis and other pediatric orthopedic conditions.

She was the first director of the Swedish Pediatric Orthopedic Quality Register during the build-up and the first years of operation. Under her leadership, the registry grew to become the first registry for common pediatric orthopedic conditions with full national coverage.

She is currently conducting a research project focusing on morbidity and mortality in middle-aged idiopathic scoliosis patients, who had been treated before the completion of growth.

Synopsis of presentation

What happens as the years go by? Results from multiple long term outcome studies after treatment of idiopathic scoliosis before maturity

The presentation will look into the results of three long term outcome studies of idiopathic scoliosis patients with both juvenile and adolescent onset. Outcome after conservative treatment will be presented and reflected against the outcome after operative treatment. Radiographic appearance, pulmonary function and different aspects of quality of life and psychological well-being will be discussed.

Results from an ongoing long-term outcome study focusing on morbidity and mortality in currently middle-aged individuals with juvenile idiopathic scoliosis treated before maturity will also be presented and discussed in the light of the outcome if no treatment is given.

Hopefully, the knowledge from these studies might help to support the patients and their parents through an often very tough period of treatment.

Marinus de Kleuver, M.D., PhD.

Bio:

Marinus de Kleuver, M.D., PhD. is professor and since 2023 Medical director of the Center for Trauma and Reconstructive Surgery, Radboud university medical center, Nijmegen, the Netherlands.

After secondary education in England, he graduated 'cum laude' from medical school at Leiden University, the Netherlands in 1990. Specialist training was completed in Amsterdam (St Lucas hospital), Buffalo, United States (Erie County Medical Center) and in Nijmegen (Sint Maartenskliniek and Radboud university medical center). From 1998 he pursued a clinical career in spinal surgery in the Sint Maartenskliniek, where he was director of the orthopedic center from 2007-2012. He was appointed professor of spinal surgery at VU university medical center in 2011. In 2016 he was appointed as full professor at Radboud university medical center, Nijmegen, the Netherlands. There he was chairman of the department of orthopedic surgery from 2016-2023, and since 2023 he is professor and medical director of the center for trauma and reconstructive surgery.

He completed an international executive program (IEP) at INSEAD business school (France) in 2006, and in 2016 followed a leadership program on complexity science (at Santa Fe Institute (SFI), New Mexico, USA).

Clinical work and research is currently focused on the surgical and non-surgical treatment of spinal deformities in children and adults. Most research work concentrates on the evaluation of outcomes and improving care.

He completed a PhD in 1998 (awarded the Dutch Orthopedic Association Mathijssen prize) and has co-authored more than 100 peer reviewed publications and several book chapters.

He is President of the Scoliosis Research Society, and past chair of the AOSpine Knowledge forum for spinal deformity and past chairman of AOSpine Europe.

He has travelled extensively, and has been visiting professor and performed live surgery demonstrations in India, China and Georgia.

Synopsis of presentation:

Pulmonary Symptoms in Adolescent and Adult Patients with A Spinal Deformity

Pulmonary symptoms such as shortness of breath with exertion and reduced exercise tolerance are commonly experienced in patients with spinal deformity (adolescents and adults). In a recent patient survey patients described their symptoms as "breathlessness" or "fatigue"/"fatigue due to limited endurance". Daily functioning of patients was limited due to the pulmonary problems and patients reported worsening of symptoms with increased fatigue.
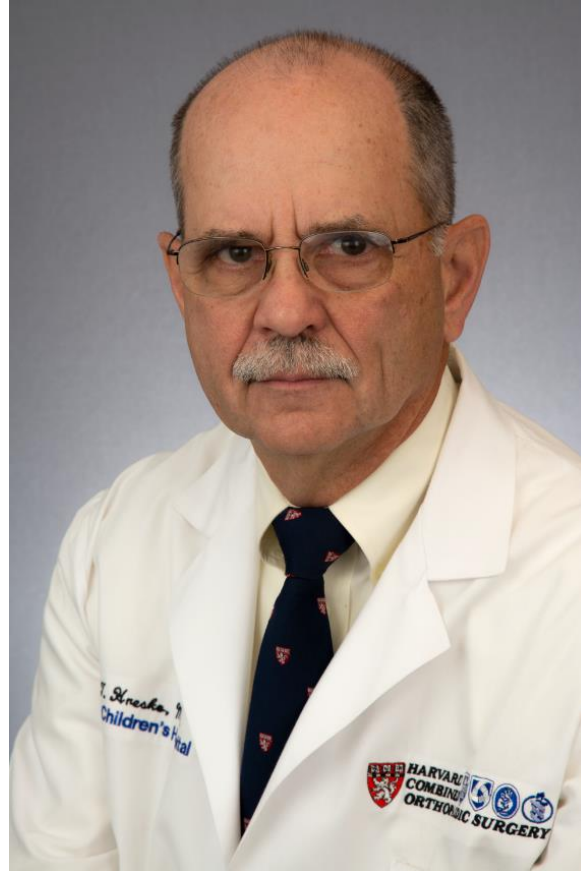
In a recent systematic review by Van Kempen et al. (2022), that included 8,723 patients with AIS, it was concluded that pulmonary function test (PFT) decline correlated with curve severity as measured by the radiographic thoracic Cobb angles.

As yet, these clinically relevant pulmonary symptoms are not routinely monitored and may have health implications later in the patient's life as pulmonary function gradually deteriorates with age and the deterioration is correlated with curve severity.

Pulmonary function tests (PFTs) have been used in an attempt to quantify pulmonary symptoms. However, a discrepancy exists between these measurement outcomes and symptoms experienced by patients, diminishing their clinical value in routine care for these patients. To evaluate pulmonary symptoms from a patient's perspective, adequate patient-reported outcome measures (PROMs) should be used, but do not yet exist.

This presentation will discuss current work that is being performed on measuring pulmonary function and exercise (in)tolerance, based on structured patient interviews, testing patients using smart vests with sensors and the to development of a patient reported outcome measure (PROM).

M. Timothy Hresko, MD

Bio:

Dr. Hresko is currently a Professor of Orthopedic Surgery at Harvard Medical School and an Attending Orthopedic Surgeon at Boston Children's Hospital. He was born and lived in Flint, Michigan until attending Harvard College. He received a Rotary Fellowship for study of health care finance and politics at London School of Economics before matriculating at the College of Physicians and Surgeons, Columbia University for a doctorate in medicine. His post graduate training included the Harvard surgical program of New England Baptist Hospital, orthopedic surgery residency at Tuft's New England Medical Center, and fellowship In Pediatric Orthopedic Surgery at Boston Children's Hospital.

His research interests have become focused on pediatric spinal deformity. He received the Hibbs Award from the Scoliosis Research Society for his presentation on the use of antifibrinolytics during scoliosis surgery in 1997. As lead author of collaborative statement of the SRS, AAOS, American Academy of Pediatrics and POSNA he advocated for scoliosis screening and was a consultant to US preventative services taskforce on the topic. His surgical practice of spine deformity includes novel treatment of surgical navigation and robotic assisted surgery. Dr. Hresko and his wife Ellen have two adult children and one recently born grandchild.

James Wynne, CPO, FAAOP

Bio:

James Wynne, CPO, FAAOP is the current SOSORT President and has been a member since 2007. He joined the board in 2017 and has served on the Scientific and Educational committees. Jim is a certified orthotist/prosthetist and has specialized in pediatrics and scoliosis since 1993. He lectures internationally on the non-operative management of scoliosis and has authored several book chapters and peer-reviewed articles on the non-operative treatment of scoliosis. His interest in SOSORT is to promote evidence-based non-operative programs for people with scoliosis and other spinal disorders.

Presidential Address

Acceptance type: Oral

O1

ENHANCING SCOLIOSIS BRACE COMFORT: THE KEY ROLE OF ORTHOTISTS

Megan Glahn Castille[1,2,3], Kayli Schwantz[1]

[1]Baylor College of Medicine, Houston, USA. [2]Align Clinic, The Woodlands, USA. [3]Scolios-us, Metairie, USA

Introduction

While scoliosis bracing is an effective method for controlling curve progression, adherence is often challenging and multifactorial, with both physical and psychosocial components. Since braces must be worn for many hours each day, brace comfort frequently appears in the literature, and superior brace comfort has been suggested to improve brace acceptance. Despite the importance of comfort, it is unclear what factors are associated with brace comfort.

Objective (s)

The purpose of this study was to identify factors associated with brace comfort in order to better understand the patient experience and improve care.

Study Design

This study consisted of a cross-sectional survey.
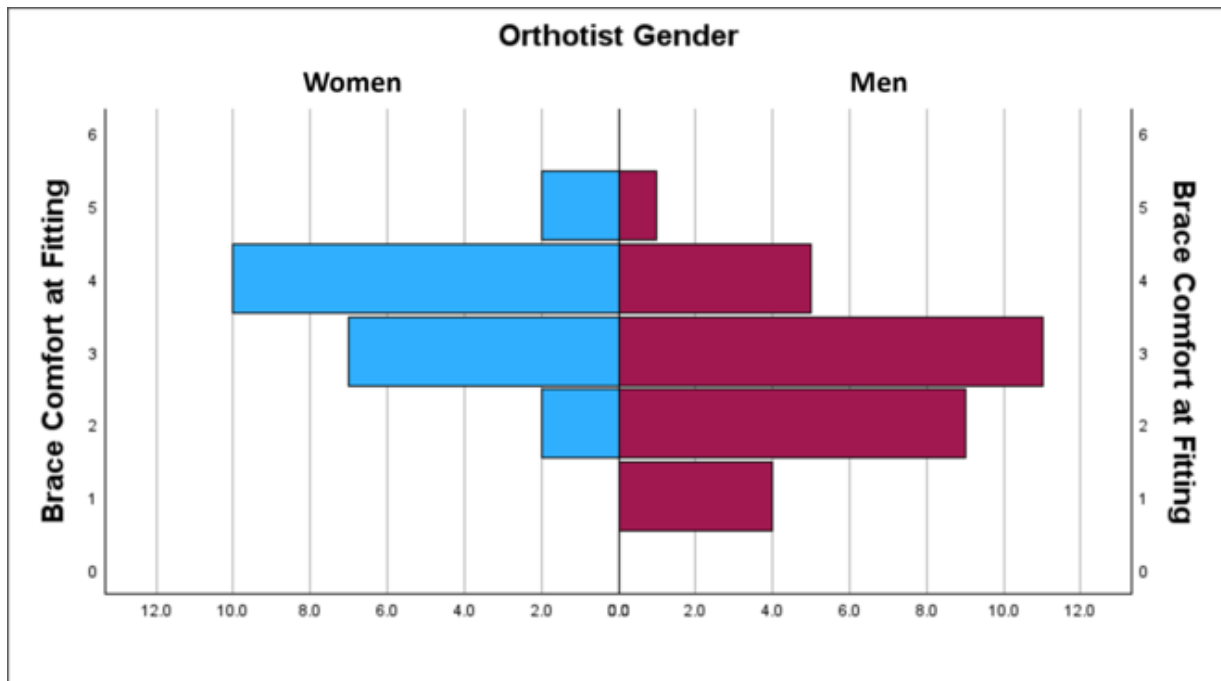
Methods

The survey included the BSSQ-Brace and questions about demographics, diagnosis, bracing appointments, comfort, and overall experience. It was distributed via the Scolios-us website, social media, and email newsletter from January to August 2023. Subjects were eligible to participate if they had a scoliosis diagnosis and were currently wearing a scoliosis brace. Descriptive statistics, Mann-Whitney U tests, and Kendall's tau-b correlations were used to analyze responses.

Results

Fifty-one subjects with a median age of 13.5 (IQR: 3) participated in the study. Subjects reported that brace comfort/discomfort (41%) is the biggest barrier to brace adherence, followed by extracurricular activities (29%), peer pressure (10%), brace appearance (6%), and bullying (2%). Orthotist gender emerged as a key factor, with significant positive associations between women orthotists and brace comfort at the fitting appointment ($U = 159.5$, $p = .002$)(Figure 1), ease of adjusting to the brace ($U =$

192.5, p = .015), and skin integrity (U = 190.0, p = .013). Brace comfort at fitting was correlated to ease of adjusting to the brace (τ_b = .420, p <.001). Brace pain at the fitting (U = 91.5, p = .014) and current brace pain (U = 81.0, p = .046) were negatively associated with BSSQ-Brace scores, while perceived brace appearance and BSSQ-Brace scores were positively correlated (τ_b = .339, p = .002). The orthotists' understanding of subjects' needs emerged as another key factor, demonstrated by strong correlations with perceived brace fit (τ_b = .515, p <.001), perceived orthotist skill level (τ_b = .660, p <.001), and desire to choose the same orthotist again (τ_b = .571, p <.001). Brace type was not found to be associated with brace comfort, ease of adjusting, or BSSQ-Brace scores.

Conclusion and significance

Brace comfort appears to be linked to the orthotist, not the brace design. Women orthotists are associated with superior brace comfort at the fitting appointment. Since brace pain and poor brace appearance are associated with increased brace-related stress, orthotists should focus on these details during fitting and follow-up appointments. Finally, orthotists should actively listen and understand patients' needs to improve patients' bracing experience.

O2

PERSONAL AND CLINICAL DETERMINANTS OF BRACE WEARING TIME IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS.

Giulia Fregna[1,2], Sara Rossi Raccagni[1], Alessandra Negrini[1], Fabio Zaina[1], Stefano Negrini[1,3,4]

[1]ISICO, Milan, Italy. [2]University of Ferrara, Ferrara, Italy. [3]University "La Statale", Milan, Italy. [4]IRCCS Istituto Ortopedico Galeazzi, Milan, Italy

Introduction

Adolescent idiopathic scoliosis (AIS) is a three-dimensional spine and trunk deformity. Bracing is an effective treatment for medium-degree curves. Thermal sensors help monitor patients' adherence (compliance), a critical issue in bracing treatment. Some studies investigated adherence determinants but rarely through sensors and in highly adherence cohorts.

Objective (s)

We aimed to verify the influence of personal and clinical variables routinely registered by physicians on adherence to brace treatment in a large cohort of consecutive AIS patients from a highly adherent cohort.

Study Design

We performed a cross-sectional study.

Methods

We enrolled AIS patients consecutively recruited in the last three years in a tertiary referral institute and treated with braces for one year. To guarantee high adherence, for years, we have provided specific support to brace treatment through a series of cognitive-behavioral interventions to patients and parents. We analyzed the effect of personal (age, Risser stage, Body Mass Index – BMI), clinical (curve magnitude, Trunk Aesthetic Clinical Evaluation – TRACE index, Angle Trunk Rotation - ATR degrees), and brace variables (prescribed wearing hours) on real brace-wearing time, recorded through thermal sensor systematic data collection with iButton. We verified each variable's distribution and described the results using average and standard deviation in case of normal distribution, otherwise with median and 95% Confidence Intervals. We analyzed the first year of therapy, thus the period with the greater brace use and we considered the effect of the variables collected at the first clinical consultation. We finally performed a t-test for gender and a one-way ANOVA analysis for all the other categorical variables. We considered a significance level of $p < 0.05$.

Results

We included 514 adolescents, age 13.8±1.6, with scoliosis worst curve of 34.5±10.3° Cobb. We found a 95% (95IC 60-101%) adherence to the brace prescription of 21.9±1.7 hours per day. Determinants included females' gender (91% vs. 84%) and age <14 years (92% vs. 88%).

Variable			Category limits (number): Adherence			F-test	P value
			Category 1	*Category 2*	*Category 3*		
Clinical	Worst curve	*°Cobb*	-			1.070	NS
	Prominence	*°Bunnel*	-			1.322	NS
	TRACE	*Percent*	-			0.741	NS
	Brace prescription	*hours per day*	23-24 (49): 87%	20-22 (145): 92%	18-19 (320): 90%	2.538	<0.1
Personal	Age	*years*	10-13 (291): 92%	14-15 (106): 88%	16-18 (117): 88%	5.434	<0.05
	Bone age	*Risser*	0 (166): 92%	1-2 (164): 90%	>2 (184): 89%	3.549	<0.05
	BMI	*kg/cmq*	-			2.171	NS

Conclusion and significance

We have identified gender, age (considered alongside bone age), and "bracing hours prescription" as critical determinants of adherence behavior. BMI, and all clinical variables (worst curve Cobb degrees, Angle of Trunk Rotation, and TRACE index for aesthetics) did not influence adherence.

O3

INFLUENCE OF SPECIFIC INTERVENTIONS ON BRACING COMPLIANCE IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS. A SYSTEMATIC REVIEW OF THE LITERATURE INCLUDING SENSORS' MONITORING

Claudio Cordani[1,2], Lia Malisano[3], Francesca Febbo[4], Giorgia Giranio[3], Matteo Johann Del Furia[2], Sabrina Donzelli[4], Stefano Negrini[1,2]

[1]Department of Biomedical, Surgical and Dental Sciences, University "La Statale", Milan, Italy. [2]IRCCS Istituto Ortopedico Galeazzi, Milan, Italy. [3]Postgraduate School of Physical Therapy and Rehabilitative Medicine, University "La Statale", Milan, Italy. [4]ISICO (Italian Scientific Spine Institute), Milan, Italy

Introduction

Adolescent idiopathic scoliosis is a common disease that, in many cases, can be conservatively treated through bracing. High adherence to brace prescription is fundamental to gaining the maximum benefit from this treatment approach. Wearable sensors are tools that objectively monitor the brace-wearing time, but their use, combined with other interventions, is poorly investigated.

Objective (s)

The aims of the current review are as follows: i) to summarize the real compliance with bracing reported by studies using sensors; ii) to find out the real brace-wearing rate through objective electronic monitoring; iii) to verify if interventions made to increase adherence to bracing can be effective according to the published literature.

Study Design

Systematic review.

Methods

We conducted a systematic review of the literature published on Medline, EMBASE, CINAHL, Scopus, CENTRAL, and Web of Science, following the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines.

Results

We identified 466 articles and included 22 articles, which had a low to good methodological quality. We found that compliance greatly varied between 21.8 and 93.9% (weighted average: 58.8%), real brace wearing time varied between 5.7 and 21 h per day (weighted average 13.3), and specific interventions seemed to improve both outcomes, with compliance increasing from 58.5 to 66% and brace wearing

increasing from 11.9 to 15.1 h per day. Two comparative studies showed positive effects of stand-alone counseling and information on the sensors' presence when added to counseling.

Conclusion and significance

Sensors proved to be useful tools for objectively and continuously monitoring adherence to therapy in everyday clinical practice. Specific interventions, like the use of sensors, counseling, education, and exercises, could increase compliance. However, further studies using high-quality designs should be conducted in this field.

O4

CAN EARLY BRACE WEAR COMPLIANCE OF PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS PREDICT FUTURE WEAR?

Alexa P. Bosco, BA, M. Timothy Hresko, MD, Christine B. Sieberg, PhD, EdM, MA, Gabriel S. Linden, BA, Shanika De Silva, PhD, Grant D. Hogue, MD, Craig M. Birch, MD, Daniel J. Hedequist, MD, Lawrence I. Karlin, MD, John B. Emans, MD

Boston Children's Hospital, Boston, USA

Introduction

Studies have shown that brace treatment decreases the likelihood of adolescent idiopathic scoliosis (AIS) patients progressing to surgery. As brace effectiveness relates to wear time in the first 6 months, identifying non-adherent patients early allows targeting behavioral interventions for at-risk individuals.

Objective (s)

This study aims to determine if 1) compliance to the brace weaning protocol at 1 month is associated with 6 month compliance, and 2) behavioral adaptation to bracing can be assessed by the Transtheoretical Model of Stages of Change.

Study Design

A prospective cohort of pediatric patients undergoing bracing treatment for AIS at a single-center.

Methods

In this prospective study, 53 AIS patients received TLSO brace treatment between 2021 and 2023. Brace wear was assessed at 1 and 6 months, categorizing patients as adherent cohort (AC) if they wore the brace ≥80% of the prescribed 18 hours/day and non-adherent (NAC) otherwise. Pre-bracing, patients completed the University of Rhode Island Change Assessment Scale (URICA). At each visit, they also completed SRS-22r, PROMIS Pediatric, and ISYQOL questionnaires. We summarized continuous variables (mean, standard deviation) and categorical variables (frequency, percentage) for each adherence group. To compare between groups, we used Wilcoxon rank sum tests for continuous variables and Fisher's exact or Pearson's chi-squared tests for categorical variables.

Results

The mean age was 13 years, 75% were female, most had Risser 0-2, and mean Cobb angle was 30.7°. Of the 46 patients with 1-month adherence data, 46% were AC and 54% were NAC, with mean daily wear times of 17.6 and 10.6 hours, respectively. Among the 35 patients with adherence data at both visits, 78% of AC patients at 1 month remained so at 6 months, while 71% of those NAC at 1 month remained non-adherent at 6 months (p=0.004) (Table 1). We observed no statistically significant differences

(p>0.05) in the demographics, radiographic measures, and patient-reported outcomes between the groups.

Per the URICA, 44% of patients were pre-contemplative, and 56% were contemplative at baseline. By 1 month, 3% of 43 patients had advanced to action stage. At 6 months, only 1 of 30 patients was in action stage. However, we observed no significant group differences in URICA stages (p=0.2) for AC or NAC groups.

Table 1. Brace Adherence to 80% of Prescribed Hours/Day

1-month compliance	6-month compliance	
	Adherent	Non-adherent
Adherent	14 (78%)	5 (29%)
Non-adherent	4 (22%)	12 (71%)

Conclusion and significance

Early brace adherence was associated with 6 month adherence to the prescribed brace wear. However, pre-treatment readiness for change was not associated with brace adherence. Compliance monitoring can identify patients at risk for poor brace adherence. Future research should target ways to enhance brace acceptance and advancing patients to action stages.

O5

IMMEDIATE EFFECT OF THE 3D BRACE ON COBB ANGLE REDUCTION IN PATIENTS WITH JUVENILE AND ADOLESCENT IDIOPATHIC SCOLIOSIS

Isis Navarro[1,2], Aleksandro Pontes[3,4]

[1]Clínica Linear, Porto Alegre, Brazil. [2]Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil. [3]Centro Ortopédico, Fortaleza, Brazil. [4]Clínica Linear, Fortaleza, Brazil

Introduction

The brace treatment for patients with scoliosis aims to prevent curve progression and, if possible, reduce it. The efficacy of the brace is assessed through the in-brace X-rays, evaluating the reduction of the curve. A 30% of in-brace correction has been considered an acceptable threshold to determine its effectiveness.
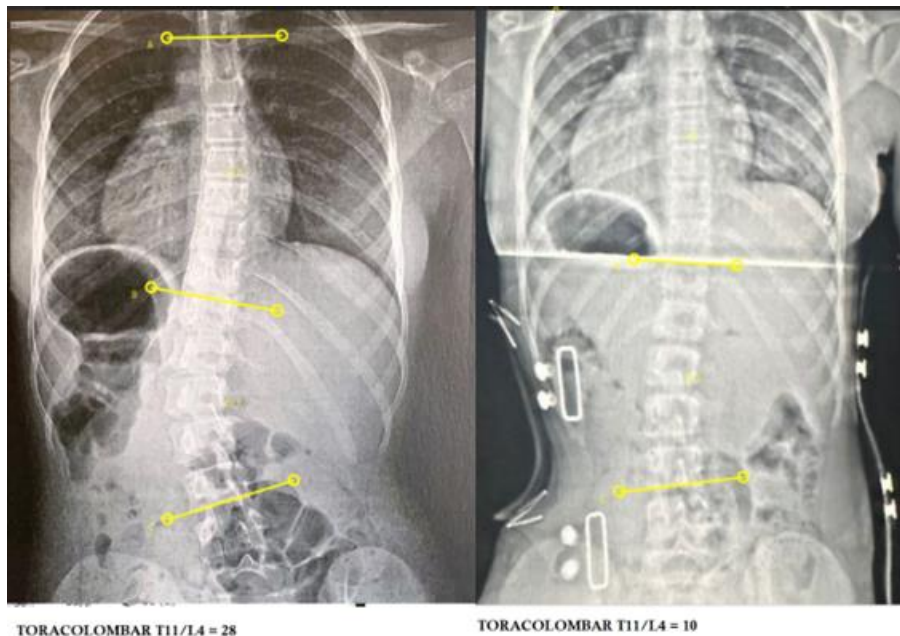
Objective (s)

This study aimed to compare the immediate effect of the 3D brace on the Cobb angle measured in the out-of-brace and in-brace X-rays.

Study Design

A retrospective comparative study.

Methods

TORACOLOMBAR T11/L4 = 28   TORACOLOMBAR T11/L4 = 10

Abstracts

This retrospective study was conducted in a private clinic in Northeast Brazil. The database comprised 175 patients included between January 2022 and October 2023. Inclusion criteria: patients with idiopathic scoliosis, aged between 8 and 16 years, who underwent in-brace X-rays within the first 30 days of brace wearing. Exclusion criteria: patients prescribed with other types of braces. The Cobb angle was measured by the same evaluator in the out-of-brace and in-brace X-rays of each patient, using the SCODIAC® application (Figure 1). All braces were built by the same physiotherapist with 15 years of orthotics experience, specifically 5 years dedicated to constructing 3D braces (Rigo and Chêneau), trained at Ortolutions and BUFA (Germany). The brace-building process involved digital scanning (Structure ST01 scanner model), mould rectification (Rodin4D v. Neo), polyurethane mould milling (SPIN 1170 milling machine model), manual fine adjustment of the mould with plaster, and thermoforming of 3mm polypropylene. A paired t-test was conducted with effect size calculation and confidence interval (CI), ($p<0.05$). Sample size calculation resulted in a minimum sample of 27 subjects (one-tailed, effect size 0.5, $\alpha = 0.05$, and $\beta = 20$).

Results

The sample consisted of 70 patients, comprising 58 girls (83%) with a mean age of 12.2 ± 2.2 years. Twenty-seven patients prescribed with other types of braces and 78 patients lacking in-brace X-rays were excluded. The analysis was conducted for the thoracic (n = 56; out-of-brace Cobb 33.2° ± 12°; in-brace 19.4° ± 10°) and lumbar region (n = 56; out-of-brace Cobb 31° ± 8.9° and in-brace 14° ± 9.4°). There was a significant difference in the Cobb angle between out-of-brace and in-brace X-rays, with an average reduction of 44% in the thoracic region and 58% in the lumbar ($p < 0.001$). In the thoracic region, the brace showed a large effect size (Glass's delta = -1.15; CI from -1.55 to -0.73) and a common language effect of 79%. In the lumbar region, there was a very large effect size (Glass's delta = -1.91; CI from -2.36 to -1.43) with a common language effect of 91%.

Conclusion and significance

The Rigo-Chêneau 3D brace has a significant and large effect on reducing the Cobb angle in the in-brace X-rays of patients with idiopathic scoliosis, emphasizing the importance of its use in conservative treatment.

O6

CORONAL DEFORMITY ANGULAR RATIO MAY SERVE AS A VALUABLE PARAMETER TO PREDICT IN-BRACE CORRECTION IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS

Zifang Huang[1], Junlin Yang[2,1], Liangyi Liang[3]

[1]the 3rd affiliated hospital of Sun Yat-sen university, Guangzhou, China. [2]Xin Hua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine, Shanghai, China. [3]xinmiao scoliosis prevention center, Guangzhou, China

Introduction

In-brace correction (IBC) plays an important role in curve progression of patients with adolescent idiopathic scoliosis (AIS) under brace treatment. We evaluated the coronal deformity angular ratio (C-DAR) as a potential predictor of IBC. Based on our experience, we postulated that a high C-DAR may result in low IBC. This relationship had not been previously studied.

Objective (s)

To evaluate the relationship of C-DAR and IBC in patients with AIS.

Study Design

A retrospective study.

Methods

Data were collected before and upon brace placement. Correlation analyses between study variables and IBC were performed. A linear regression model was established on the basis of C-DAR.

Results

At brace fitting, the average age was 12.62 ± 1.16 (range, 10–15) years and mean major curve Cobb angle was $32.14 \pm 4.66°$ (range, 25–40°). Mean IBC was $59.62\% \pm 22.03\%$ (range, 16.2–100%). IBC had significant correlation with C-DAR (r=-0.69; 95% confidence interval, -0.77 to -0.61; p<.001). IBC was not significantly correlated with age, sex, height, weight, BMI, menstrual status, or Risser sign. A simple linear regression model established that in-brace correction=115.4-10.7×C-DAR.

Conclusion and significance

C-DAR has strong negative correlation with IBC and may estimate the expected IBC. The usage of C-DAR may obviate the need for flexibility radiographs, such as supine or supine lateral bending radiographs.

O7

FACTORS THAT INFLUENCE IN-BRACE CORRECTION IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS

Zifang Huang[1], Junlin Yang[2,1], liangyi Liang[3]

[1]3rd affiliated hospital of Sun Yat-sen University, Guangzhou, China. [2]Xin Hua Hospital Affiliated to Shanghai Jiao Tong University School of Medicine, Shanghai, China. [3]xinmiao scoliosis prevention center, Guangzhou, China

Introduction

In-brace correction might be the most important predictive factor for curve progression in braced patients with AIS, so identify the factors influencing in-brace correction is valuable.

Objective (s)

To identify the factors affecting in-brace correction in patients with adolescent idiopathic scoliosis (AIS).

Study Design

 A retrospective study.

Methods

We performed a retrospective analysis of patients with AIS receiving Gensingen brace treatment in our scoliosis center from July 2015 to October 2017 was performed. The selection of patients was in accordance with the Scoliosis Research Society inclusion criteria for a bracing study. Some radiographic and clinical parameters, including the Cobb angle, ribevertebra angle difference, coronal and sagittal balance, lumbarepelvic relationship (LPR), Risser sign, curve type, age, gender, height, weight, body mass index, and menstrual status were collected. The correlation and difference analyses were performed to identify the factors influencing in-brace correction.

Results

A cohort of 112 patients with AIS (94 girls and 18 boys) were included in the present study. The mean in-brace correction was 59.29%±22.33% (range, 16.22% - 100.00%). In-brace correction showed a significantly negative correlation with the major curve Cobb angle, minor curve Cobb angle, total curve Cobb angle, and LPR ($P < 0.05$ for all). Sagittal and coronal imbalance could reduce the curve correction ($P < 0.001$ and $P=0.008$, respectively). The remaining parameters were not related to in-brace correction.

Conclusion and significance

In-brace correction in the present study was 59.29%±22.33% (range, 16.22%-100.00%). Some factors, including the Cobb angle, sagittal and coronal balance, and LPR, have an effect on in-brace correction. The results from the present study can provide some useful information for brace design and fabrication.

O8

IN-BRACE CORRECTION DURING PROVIDENCE NIGHTTIME BRACE TREATMENT FOR IDIOPATHIC SCOLIOSIS PREDICTS CURVE PROGRESSION

Karina Zapata, Kara Davis, Chan-Hee Jo, Daniel Sucato, Megan Johnson

Scottish Rite for Children, Dallas, USA

Introduction

Lack of in-brace correction (IBC) is associated with brace treatment failure. However, the role of IBC on curve progression in Providence nighttime brace treatment for idiopathic scoliosis is unclear.

Objective (s)

To determine whether IBC and curve progression differs by Providence brace design and major curve location, and whether IBC predicts curve progression after adjusting for possible confounding variables.

Study Design

retrospective review

Methods

The charts of 232 children (45 boys, 187 girls) with idiopathic scoliosis ages 10 to 16 years, Risser stages 0 to 2, major curves 15° to 40° treated with Providence nighttime braces with in-brace radiographs were retrospectively reviewed until final visit of skeletal maturity or surgery. IBC was calculated by comparing the measurement differences between the curve magnitude from the standing radiograph at brace prescription and the supine in-brace radiograph 2 months later. The Providence brace design (double, thoracolumbar, or lumbar) was determined by pad location from the in-brace radiograph. Major curve location (thoracic, thoracolumbar, or lumbar) was defined by location of the primary curve apex. An ANOVA for continuous variables and chi-square test for categorical variables was used for between-group comparisons. Pearson's correlations examined relationships between IBC and curve progression. Odds ratio (OR) and 95% confidence intervals (CI) were reported from logistic regression by using curve progression ≥6° (yes/no) as an outcome variable.

Results

IBC of the primary curve averaged 103% ± 29% (n=232) and secondary curve averaged 74% ± 29% (n=120). Thoracolumbar brace designs had higher IBC than lumbar and double brace designs (116% vs. 97% vs. 85%, $p<0.001$) but no difference in curve progression (2° vs. 2° vs. 3°). Thoracolumbar curve location had higher IBC of the primary curve than lumbar and thoracic curve locations (115% vs. 93% vs. 85%, $p<0.001$), but not less curve progression (1° vs. 4° vs. 3°, $p = 0.091$, Table). IBC of the primary curve was negatively correlated with curve progression ≥6° ($r = -0.33$, $p<0.001$), curve magnitude ($r = 0.19$, $p=0.003$), and body mass index (BMI, [$r = -0.13$, $p=0.047$]). Multivariate regression analysis adjusting for

age, biologic sex, BMI, triradiate cartilage status, curve magnitude, and Risser stage revealed that decreased IBC was still associated with curve progression (OR 0.98, 95% CI 0.97-0.99), in addition to open triradiate cartilage status (OR 3.55, 95% CI 1.60-8.34) and curve magnitude (OR 1.09, 95% CI 1.00-1.19). Each additional increase of 1% IBC was associated with a 2% decrease in the odds of curve progression.

	Thoracic (n=34)	Thoracolumbar (n=114)	Lumbar (n=84)	Anova p-value	Thoracic vs. TL	Thoracic vs. L	TL vs. L
Biologic sex							
Female	91% (n=31)	77% (n=88)	81% (n=68)	0.192			
Male	9% (n=3)	23% (n=26)	19% (n=16)				
Race/Ethnicity							
White	56% (n=19)	75% (n=86)	71% (n=60)	0.012*	0.066	0.008*	0.132
Hispanic	18% (n=6)	12% (n=14)	13% (n=11)				
Black	12% (n=4)	7% (n=8)	4% (n=3)				
Other	15% (n=5)	4% (n=4)	2% (n=2)				
Asian	0% (n=0)	2% (n=2)	10% (n=8)				
Initial age (years)	12.2±1.4 (n=34)	12.6±1.4 (n=114)	12.5±1.3 (n=84)	0.219			
Brace design							
Double	82% (n=28)	10% (n=11)	40% (n=34)	<0.001*	<0.001*	<0.001*	<0.001*
Thoracolumbar	15% (n=5)	89% (n=102)	15% (n=13)				
Lumbar	3% (n=1)	1% (n=1)	44% (n=37)				
Initial Risser stage							
0	79% (n=27)	68% (n=78)	78% (n=65)	0.312			
1	15% (n=5)	15% (n=17)	8% (n=7)				
2	6% (n=2)	17% (n=19)	14% (n=12)				
Initial TRC status							
Open	53% (n=18)	44% (n=50)	54% (n=45)	0.351			
Closed	47% (n=15)	56% (n=64)	46% (n=39)				
Initial menarche							
Pre	71% (n=22)	74% (n=65)	65% (n=44)	0.445			
Post	29% (n=9)	26% (n=23)	35% (n=24)				
Initial Cobb (°)	23±3 (n=34)	24±4 (n=114)	24±4 (n=84)	0.088			
In-brace correction (%)							
Primary curve	85±28 (n=34)	115±29 (n=114)	93±24 (n=84)	<0.001*	<0.001*	0.991	<0.001*
Secondary curve	86±28 (n=25)	73±26 (n=38)	69±30 (n=57)	0.040*	0.196	0.030*	0.698
Years braced	2.4±1.2 (n=33)	2.2±0.9 (n=113)	2.2±0.8 (n=84)	0.506			
Total brace wear (hr/day), sensor data	6.0±2.5 (n=29)	6.8±2.4 (n=89)	7.2±2.4 (n=67)	0.079			
Growth (cm)	11.2±7.6 (n=33)	9.7±5.7 (n=113)	9.6±5.9 (n=84)	0.396			
Final Cobb (°)	26±12 (n=34)	24±10 (n=114)	26±11 (n=84)	0.441			
Final curve progression (°)	4±12 (n=34)	1±8 (n=114)	3±10 (n=84)	0.074			
Final curve <30° (%)	76% (n=26)	71% (n=81)	68% (n=57)	0.641			
Curve improved ≥6°	15% (n=5)	25% (n=29)	18% (n=15)	0.304			
Curve progressed ≥6°	24% (n=8)	27% (n=31)	32% (n=27)	0.599			
Progression to full-time brace	24% (n=8)	6% (n=7)	14% (n=12)	0.014*	0.009*	0.347	0.093
Progression to surgery	6% (n=2)	2% (n=2)	6% (n=5)	0.174			

*p<0.05. TRC=triradiate cartilage

Conclusion and significance

The thoracolumbar brace design has the highest IBC, likely due to thicker pads than the lumbar brace design with larger forces. IBC is an independent predictor of curve progression in Providence nighttime bracing. A bigger focus on IBC is warranted when using the Providence brace in the treatment of idiopathic scoliosis.

O9

Does Apical Vertebra Location Influence the Final Outcome of Conservative Treatment for Idiopathic Scoliosis?

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Introduction

Idiopathic scoliosis represents a complex spinal alteration. The apical vertebra, situated at the apex of the scoliotic curve, holds a pivotal position in determining the overall spinal alignment and, consequently, the efficacy of conservative treatments. Several studies have shown that patients with apical vertebrae located in the thoracic spine are more likely to have progression of their curves than patients with apical vertebrae located in the lumbar spine. Additionally, patients with apical vertebrae located in the upper thoracic spine are more likely to have poorer outcomes than patients with apical vertebrae located in the lower thoracic spine. Therefore, understanding the nuanced relationship between the characteristics of the apical vertebra and treatment outcomes is paramount for tailoring therapeutic strategies and optimizing patient care.

Objective (s)

This study aims to comprehensively analyze the influence of apical vertebra location on the outcome of conservative treatment of idiopathic scoliosis.

Study Design

This is an observational controlled cohort study nested in a prospective clinical ongoing database in patients with Scoliosis.

Methods

From a consecutive series of patients included in a prospective database, we selected 491 patients with Adolescent Idiopathic Scoliosis with curves of 20-40°(mean: 27.89°± 5.15°), Risser grade 0-2 who were treated with a brace at 2 years minimum follow up (mean: 53.62 ± 49.63 months). X-rays were used to obtain Cobb degrees and torsion of the apical vertebrae (Perdriolle's method). Three outcomes were distinguished according to SRS-SOSORT criteria. The rotation of the apex vertebra and the degrees of the curve were analyzed using statistical analysis.

Results

The results of our study showed that in 491 patients with a definite outcome, the Cobb mean value was initially 27.89±5.158 SD and 16.99±15.85 SD at follow-up. Perdriolle was initially 11.9±7.319 SD and

Abstracts

3.741±7.816 at follow-up. Overall, 411 patients (84%) obtained a curve correction, and stabilization was achieved in 70 cases (14%). Ten patients experienced curve progression (2%), and 1 patient was recommended for surgery because the curve at follow-up was over 45°.

The analysis of subgroups shows statistically significant differences between the means of L1 and D9, L1 and D8, L1 and D7, L2 and D7, and D12 and D7, the p-value is less than 0.05 (Table 1). Moreover, a significant correlation was shown between the apex vertebra and mean Cobb correction (p<0.0001).

Tukey's multiple comparisons test	Mean Diff.	95.00% CI of diff.	Summary	Adjusted P Value
L1 vs. L2	-1.152	-3.489 to 1.186	ns	0.9615
L1 vs. L3	-2.522	-7.166 to 2.121	ns	0.9109
L1 vs. D12	-0.5172	-4.618 to 3.583	ns	>0.9999
L1 vs. D11	-4.2	-9.789 to 1.389	ns	0.4322
L1 vs. D10	-3.267	-8.855 to 2.322	ns	0.8458
L1 vs. D9	-4.345	-7.907 to -0.7834	**	0.0029
L1 vs. D8	-4.067	-7.205 to -0.9292	***	0.0009
L1 vs. D7	-9.997	-17.03 to -2.968	***	0.0001
L2 vs. L3	-1.371	-6.031 to 3.290	ns	>0.9999
L2 vs. D12	0.6345	-3.485 to 4.754	ns	>0.9999
L2 vs. d11	-3.048	-8.651 to 2.555	ns	0.9098
L2 vs. D10	-2.115	-7.718 to 3.488	ns	0.9978
L2 vs. D9	-3.194	-6.777 to 0.3901	ns	0.1506
L2 vs. D8	-2.915	-6.078 to 0.2472	ns	0.1129
L2 vs. D7	-8.845	-15.89 to -1.805	**	0.0017
L3 vs. D12	2.005	-3.433 to 7.444	ns	0.9983
L3 vs. d11	-1.677	-8.245 to 4.890	ns	>0.9999
L3 vs. D10	-0.7441	-7.312 to 5.824	ns	>0.9999
L3 vs. D9	-1.823	-6.958 to 3.312	ns	0.999
L3 vs. D8	-1.545	-6.478 to 3.389	ns	0.9998
L3 vs. D7	-7.475	-15.30 to 0.3553	ns	0.0814
D12 vs. d11	-3.683	-9.948 to 2.582	ns	0.8396
D12 vs. D10	-2.749	-9.014 to 3.516	ns	0.9878
D12 vs. D9	-3.828	-8.478 to 0.8215	ns	0.2652
D12 vs. D8	-3.55	-7.976 to 0.8762	ns	0.3103
D12 vs. D7	-9.48	-17.06 to -1.902	**	0.0018
d11 vs. D10	0.9333	-6.230 to 8.096	ns	>0.9999
d11 vs. D9	-0.1454	-6.149 to 5.858	ns	>0.9999
d11 vs. D8	0.1328	-5.699 to 5.965	ns	>0.9999
d11 vs. D7	-5.797	-14.13 to 2.538	ns	0.5817
D10 vs. D9	-1.079	-7.082 to 4.925	ns	>0.9999
D10 vs. D8	-0.8006	-6.633 to 5.031	ns	>0.9999
D10 vs. D7	-6.731	-15.07 to 1.605	ns	0.2984
D9 vs. D8	0.2782	-3.654 to 4.211	ns	>0.9999
D9 vs. D7	-5.652	-13.01 to 1.711	ns	0.3914
D8 vs. D7	-5.93	-13.15 to 1.294	ns	0.2702

Conclusion and significance

Our study demonstrates that the apical vertebra plays a significant role in the outcome of conservative treatment for AIS. Patients with apical vertebrae located in the thoracic spine, particularly in the upper thoracic spine, were more likely to have poorer outcomes compared to patients with apical vertebrae located in the lumbar spine. These findings highlight the importance of considering the location of the apical vertebra when determining the prognosis and treatment plan for patients with AIS.

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O10

BRACING AT LATER GROWTH STAGE FOR SEVERE SCOLIOSIS > 40O CAN BE AN ALTERNATIVE FOR PATIENTS REFUSING SURGICAL TREATMENT&NBSP;

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Introduction

According to Scoliosis Research Society (SRS) brace treatment for Adolescent Idiopathic Scoliosis (AIS) is recommended for curves $25^{o} – 40^{o}$ at Risser 0-3. Many recent studies have provided evidence that brace can be more effective when combined with Physiotherapeutic Scoliosis Specific Exercises (PSSE), even for curves exceeding 40°. However, it is still debatable whether brace is necessary at late growth stage, as the risk for progression is usually lower than growth spurt.

Objective (s)

The aim of our study was to evaluate the effectiveness of non-operative treatment with brace and PSSE-Schroth exercises, for curves more than 40° at late growth.
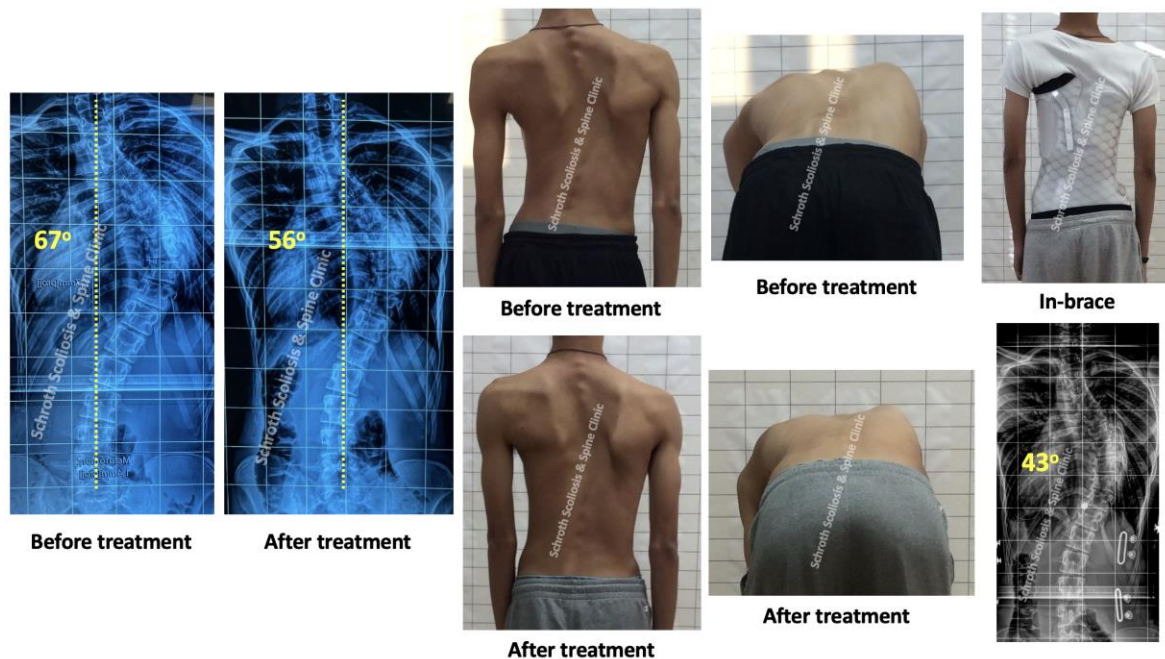
Study Design

Prospective cohort study

Methods

We recruited 76 patients (58 females – 18 males) with mean Cobb angle Thoracic (Th) 50.9^{o} $(40^{o} – 81^{o})$ and Lumbar (Lu) 46.1^{o} $(40^{o} – 82^{o})$, Risser 3.54 (3-4), Angle Trunk Rotation (ATR) Th 14.3^{o} and Lu 12.7^{o}, who refused surgical treatment and referred for bracing. Our inclusion criteria were Cobb angle for major curve > 40° with Risser sign 3 or 4. All patients were subscribed asymmetric Cheneau brace and PSSE-Schroth exercises. The brace wearing time was between 12 and 18 hours, based on prognostic criteria. PSSE-Schroth curve type classification was used for brace design and 3D correction during exercises. Compliance was self-reported and categorized as excellent, moderate, or poor. Our outcome parameters were Cobb angle difference, number of patients led to surgical treatment, ATR, Italian Spine Youth Quality of Life (ISYQOL) questionnaire score and Trunk Asymmetry Clinical Evaluation Scale (TRACE). Average follow-up was 28.4 months. Paired t-test was used for statistical analysis.

Results

After treatment 37 patients (48.7%) remained stable, 32 improved > 5° (42.1%) and 7 progressed > 5° (9.2%). Cobb angle post-treatment was significantly improved with mean Th 45.4° (31° – 79°, p=0.007) and Lu 43.2° (28° – 80°, p=0.01). In total, 9 patients (11.8%) had operative treatment with spinal fusion, all of them having double curves. Average in-brace Cobb angle correction (IBC) was 31.4% for Th and 36.1% for Lu curves. ATR was significantly improved both for thoracic (ATR post 11.3°, p=0.003) and lumbar (ATR post 9.4°, p=0.02). ISYQOL score significantly improved from 53% to 72% (p=0.0001) and TRACE score significantly decreased from 8.8 to 6.7 (p=0.03).

Conclusion and significance

A combined non-operative treatment with asymmetric Cheneau brace and PSSE-Schroth exercises, can be effective alternative option for patients refusing surgical treatment, at a later growth stage. In our group, only 11.8% finally required spinal fusion. The progression rate and avoidance of surgical treatment were markedly less in single curves compared to double curves.

O11

EFFECTIVENESS OF NIGHTTIME BRACING IN BOYS WITH IDIOPATHIC SCOLIOSIS

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Introduction

The few studies evaluating brace treatment outcomes specific to boys have found inferior results. The effectiveness of nighttime Providence bracing in boys with idiopathic scoliosis is unknown.

Objective (s)

To evaluate the effectiveness of nighttime brace treatment in boys with idiopathic scoliosis compared to girls.

Study Design

retrospective review

Methods

The charts of 240 children (48 boys, 192 girls) with idiopathic scoliosis ages 10 to 16 years, Risser stages 0 to 2, major curves 15° to 40° with predominantly primary thoracolumbar/lumbar curves treated with Providence nighttime braces prescribed to be worn at least 8 hours per night were retrospectively reviewed until either skeletal maturity or surgery. Brace adherence was measured using iButton temperature sensors at brace discharge (n=189). Brace outcomes included curve progression ≥6° and progression to surgery. A t-test for continuous variables and chi-square test for categorical variables were used for between-group comparisons (boys versus girls; subanalyses: Risser stage 0, curves <25° and ≥25°, ages 10-12).

Results

At brace prescription, boys were older and had a more advanced Risser stage than girls, but did not differ by major curve magnitude (23° vs. 23°), triradiate cartilage status, body mass index (18.3 kg/m^2 vs. 18.2 kg/m^2), primary curve location, or years braced (2.3 years vs. 2.2 years, Table). In-brace correction was similar (100% boys vs. 104% girls). At final visit, boys grew more (12.0 cm vs. 9.3 cm), had lower brace wear adherence throughout the entire duration of brace wear than girls (6.0 hours vs. 7.2 hours, p=0.035). Boys had greater curve progression (5° vs. 2°, p=0.042) from brace prescription to final visit and required surgery significantly more than girls (10% vs. 3%, p=0.046).

Boys Risser 0 (n=31) did not progress more (6° vs. 2°) but required surgery more frequently than girls (16% vs. 4%, p=0.026). Boys with curves <25° (n=36) did not progress more than girls (3° vs. 1°, p=0.255) nor require surgery more (8% vs. 1%, p=0.056). Boys with curves ≥25° (n=12) progressed more than girls

(9° vs. 3°, p=0.037) but did not require surgery significantly more (17% vs. 8%, p=0.589). Boys ages 10 to 12 years (n=13) did not progress more than girls (9° vs. 2°, p=0.197) but required surgery more than girls (23% vs. 4%, p=0.032). There was a positive association between greater initial curve magnitude and curve progression in boys (r=0.20, p=0.032) but not in girls. There was no association between brace adherence and curve progression (p=0.053).

	Boys (n=48)	Girls (n=196)	p-value
Race/Ethnicity			
White	65% (n=31)	73% (n=140)	0.408
Hispanic	14% (n=7)	13% (n=26)	
Black	10% (n=5)	6% (n=12)	
Other	8% (n=4)	4% (n=7)	
Asian	4% (n=2)	4% (n=8)	
Initial age (years)	13.7±1.4 (n=48)	12.3±1.2 (n=192)	<0.001*
Initial body mass index (kg/m^2)	18.3±2.1 (n=48)	18.2±2.7 (n=188)	0.877
Initial primary curve			
Thoracic	3% (n=6)	17% (n=32)	0.347
Thoracolumbar	56% (n=27)	47% (n=90)	
Lumbar	38% (n=18)	36% (n=70)	
Brace design			
Double	17% (n=8)	35% (n=67)	0.053
Thoracolumbar	65% (n=30)	48% (n=91)	
Lumbar	17% (n=8)	16% (n=31)	
Initial Risser stage			
0	65% (n=31)	77% (n=150)	<0.001*
1	4% (n=2)	14% (n=27)	
2	31% (n=15)	10% (n=19)	
Initial triradiate cartilage			
Open	46% (n=28)	51% (n=100)	0.376
Closed	54% (n=26)	48% (n=92)	
Initial menarchal status			
Pre		69% (n=133)	
Post		31% (n=59)	
Initial curve magnitude (°)	23±4 (n=48)	23±4 (n=192)	0.902
In-brace correction (%)	100±30 (n=45)	104±29 (n=187)	0.445
Years braced	2.3±0.9 (n=47)	2.2±0.9 (n=190)	0.366
Total brace wear (hr/day), according to sensor data	6.0±2.7 (n=38)	7.2±3.0 (n=151)	0.035*
Growth (cm)	12.0±7.1 (n=48)	9.3±5.6 (n=187)	0.006*
Final age (years)	16.6±1.3 (n=48)	15.0±1.3 (n=192)	<0.001*
Final curve magnitude (°)	28±14 (n=48)	25±10 (n=192)	0.141
Final curve progression (°)	5±12 (n=48)	2±9 (n=192)	0.042*
Final curve less than 30° (%)	58% (n=28)	72% (n=139)	0.073
Curve improved ≥6°	17% (n=8)	22% (n=42)	0.427
Curve progressed ≥6°	38% (n=18)	28% (n=53)	0.179
Progression to full-time brace	6% (n=3)	13% (n=24	0.309
Progression to surgery	10% (n=5)	3% (n=6)	0.046*

*p<0.05. Initial=time of brace prescription; final=final visit a skeletal maturity, or progression to surgery.

Conclusion and significance

Boys with idiopathic scoliosis with predominantly primary thoracolumbar/lumbar curves treated in nighttime braces have worse outcomes than girls, but still do well overall. Boys with larger curves are especially at risk of curve progression.

O12

THE CLINICAL OUTCOMES OF LUMBOSACRAL ORTHOSIS FOR ADOLESCENT IDIOPATHIC SCOLIOSIS PATIENTS WITH MAJOR THORACOLUMBAR/LUMBAR CURVES

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Introduction

Lumbosacral orthosis (LSO) is a type of brace that mainly designed to correct the single thoracolumbar or lumbar (TL/L) curves. However, few articles have discussed its clinical effectiveness compared with traditional thoracolumbosacral orthosis (TLSO).

Objective (s)

For the first time, this study evaluates the effectiveness of LSO for both major TL/L and minor thoracic curves in AIS and compares its clinical outcomes with TLSO.

Study Design

A prospective controlled study.

Methods

AIS with main TL/L and minor thoracic curves receiving TLSO or LSO are enrolled. The demographic and radiographic data are compared between two groups. The clinical outcome is also compared. The risk factor of curve progression is identified and the cut-off value is determined.

Results

A total of 82 AIS with major TL/L and minor thoracic curves, including 44 TLSO and 38 LSO, are enrolled. The initial TL/L curves showed no difference. However, the thoracic curves were larger in TLSO group at baseline (25.98±7.47° vs. 18.71±5.95°, P<0.001). At last follow-up, LSO achieved similar outcomes for TL/L curves compared to TLSO, but showed less effectiveness for thoracic curves. The initial thoracic curve magnitude was identified as a risk factor of minor curves' out-comes in LSO group. The ROC curve found that the cut-off value of thoracic curves was 21° to predict the treatment outcomes.

Conclusion and significance

LSO can achieve satisfactory outcomes for TL/L curves, but is less effective for thoracic curves compared to TLSO. For AIS patients with main TL/L and minor thoracic curves, LSO is a viable option with better quality of life in clinical practices. The initial thoracic curve magnitude is a risk factor affecting the treatment outcomes of minor curves and the cut-off value of 21° may guide the use of different braces.

O13

CAN CURRENTLY USED QUESTIONNAIRES LIKE ODI (AND SRS-22) DISCRIMINATE PATIENTS WITH SCOLIOSIS IN A POPULATION WITH CHRONIC BACK PAIN?

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Introduction

Scoliosis patients can experience non-specific chronic back pain (CBP) and symptoms connected to their deformity. Discriminating between specific and non-specific pain in scoliosis, as well as between pain due to scoliosis or not in CBP patients would be very helpful in providing a more appropriate treatment. Commonly used questionnaires, explore some of these features, like Oswestry Disability Index (ODI) for CBP and Scoliosis Research Society 22 questionnaire (SRS-22) for scoliosis.

Objective (s)

This study aims to check if the ODI can discriminate limitations in scoliosis and non-scoliosis adult patients suffering from low back pain. We also tested the SRS-22 for the same goal as a secondary aim in a subgroup of patients.

Study Design

Retrospective study

Methods

We divided patients into two groups, one with scoliosis and one without. We included in the Scoliosis Group (SG) participants with a degenerative spinal curve larger than 10° Cobb and those with Adolescent Idiopathic Scoliosis and a curve larger than 30°. The other patients were in the non-specific back pain group (NBP). We excluded patients with other deformities like spinal stenosis and Spondylolisthesis.

We compared the ODI total scores, and we analysed each single item. For single items, we assigned a score ranging from 1 to 6 to each answer, with higher scores meaning a worse condition; for the SRS-22, scores ranged from 1 to 5, with higher scores reflecting a better condition.

We used a t-test to compare each single item and the total scores.

Results

Nine hundred eighty-nine patients completed the ODI and entered the study, 516 (437 females) in the SG and 473 (275 females) in the NBP. Compared to NBP, at baseline, SG patients were slightly older

(63±9 vs 61±9, p=0.001), had a reduced height (158±17 vs 164±15, p<0.001) and weight (66±21 vs 72±17, p<0.001).

The overall ODI score was similar for scoliosis and NBP (27.38 vs 26.20, p=0.23), while for lifting and standing, the impairment was more relevant for SG (table 1).

For the SRS-22, filled by 329 SG patients and 81 NBP, there were no differences in the total score or any item.

Table 1

	Pain	Self care	lifting	walking	sitting	standing	sleepling	social life	travelling	work
Scoliosis	2.65 ± 1.05	1.71±0.98	3.06±1.36	2.06±1.16	2.19±1.10	2.78±1.22	1.98±0.81	2.46±1,30	2.12±1.18	2.75±0.99
No scoliosis	2.69±1.08	1.68±0.96	2.78±1.28	1.92±1.12	2.30±1.18	2.49±1.18	2.08±0.83	2.42±1.26	2.09±1.13	2.62±1.04
p value	0.6	0.56	0.001	0.051	0.14	0.0002	0.08	0.64	0.67	0.052

Conclusion and significance

Patients with scoliosis confirmed a worse performance in lifting and standing, as previously found. Despite being statistically significant, the differences were relatively small, making clinical interpretation difficult. The ODI seems appropriate and helpful for this group of patients and can be used in clinical practice. The SRS-22, which is supposed to be more specific for scoliosis, did not show any ability to discriminate between different kinds of patients.

Measuring QoL in patients with scoliosis and back pain remains challenging. It could be worth trying to design a new tool more specific for patients affected by scoliosis.

O14

BACK PAIN PREVALENCE AND PROMIS SCORES IN CHILDREN WITH HYPERKYPHOSIS COMPARED TO IDIOPATHIC SCOLIOSIS

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Introduction

Back pain and related health-related quality of life is a common concern in children with hyperkyphosis. However, the prevalence of back pain and Patient Reported Outcome Measurement Information Systems (PROMIS) scores in children with hyperkyphosis are unknown.

Objective (s)

To compare back pain prevalence and PROMIS Pain Interference, Mobility, and Anxiety scores in children with hyperkyphosis and idiopathic scoliosis (IS).

Study Design

Retrospective review

Methods

The charts of children with hyperkyphosis and IS ages 8 to 18 years who completed the PROMIS Pediatric Computer Adapted Test Pain Interference, Mobility, and Anxiety measures were retrospectively evaluated from April 2021 to June 2023. Comparisons were made between hyperkyphosis and IS groups and within Scheuermann kyphosis (SK) and postural kyphosis subgroups and with Chi-square tests for categorical variables, Mann-Whitney tests for continuous variables and logistic regression analyses.

Results

A total of 308 children (161 boys, 147 girls) with hyperkyphosis and 1150 children (272 boys, 878 girls) with IS were included. Children with hyperkyphosis did not report back pain significantly more than those with IS (44% vs. 39%) but at a higher pain intensity (1.5 vs. 1.2 out of 5, $p<0.01$). The hyperkyphosis group had increased age (14.4 vs 13.9, $p<0.001$), male sex (52% vs. 24%, $p<0.001$), BMI percentile (63 vs 57, $p<0.001$), Spanish than English speakers (16% vs. 9%, $p<0.001$), public insurance (36% vs. 29%, $p=0.042$), depression or anxiety (45% vs. 35%, $p=0.041$), ODI-9 scores (18% vs. 15%, $p<0.001$), and PROMIS Pain scores (45.4 vs. 43.4, $p<0.01$) than the IS group. PROMIS Mobility scores were lower for the hyperkyphosis group (50.6 vs 53.2, $p <0.0001$). Higher ODI-9, higher PROMIS Pain, and lower PROMIS Mobility scores remained significant after multivariate regression analysis adjusted for age, BMI percentile, sex, language, insurance type, and race/ethnicity ($p<0.01$). The hyperkyphosis group was more likely to be referred to physical therapy (44% vs 17%, $p<0.001$).

Children with SK did not report back pain significantly more than those with postural kyphosis (54% vs. 41%) nor at a higher intensity. Children with SK had increased age, male sex, BMI percentile, PROMIS Pain scores, and botheration by their appearance. PROMIS Mobility scores were lower for SK than postural kyphosis (Table). Higher PROMIS Pain and lower PROMIS Mobility did not remain significant after multivariate modeling analysis adjusted for age, BMI percentile, and sex. The SK subgroup was more likely to be referred to physical therapy (61% vs. 39%, p<0.01).

Table. Patient characteristics, patient-reported outcomes, and orders placed in idiopathic scoliosis compared to kyphosis and by Scheuermann compared to postural kyphosis subtype

	Idiopathic Scoliosis	Kyphosis	p-value	Scheuermann Kyphosis	Postural Kyphosis	p-value
Age (years)	13.9±2.0 (n=1150)	14.4±2.0 (n=308)	<0.001*	15.0±2.0 (n=67)	14.2±2.1 (n=241)	0.002*
Biologic Sex						
Female	76% (n=878)	48% (n=147)	<0.001*	25% (n=17)	54% (n=130)	<0.001*
Male	24% (n=272)	52% (n=161)		75% (n=50)	46% (n=111)	
Race/Ethnicity						0.59
White	45% (n=515)	44% (n=136)	<0.001*	51% (n=34)	43% (n=102)	
Hispanic	21% (n=242)	35% (n=109)		31% (n=21)	37% (n=88)	
Black	20% (n=225)	3% (n=9)		3% (n=2)	3% (n=7)	
Asian	10% (n=115)	7% (n=20)		3% (n=2)	8% (n=18)	
Other	5% (n=52)	11% (n=34)		12% (n=8)	11% (n=26)	
Language						
English	91% (n=1039)	84% (n=258)	<0.001*	85% (n=57)	84% (n=201)	0.85
Spanish	9% (n=102)	16% (n=48)		15% (n=10)	16% (n=38)	
Insurance						
Private	60% (n=688)	55% (n=169)	0.042*	52% (n=35)	56% (n=134)	0.31
Public	29% (n=335)	36% (n=112)		34% (n=23)	37% (n=89)	
Self-pay	11% (n=127)	9% (n=27)		13% (n=9)	8% (n=18)	
Body Mass Index Percentile	57±31 (n=1144)	63±34 (n=307)	<0.001*	?±? (n=67)	?±? (n=241)	<0.001*
Back Pain Yes	38% (n=442)	44% (n=135)	0.088	54% (n=36)	41% (n=99)	0.066
Depression or Anxiety Yes	35% (n=155)	45% (n=60)	0.041*	36% (n=13)	49% (n=47)	0.20
Bothered by Appearance Yes	26% (n=279)	31% (n=66)	0.112	46% (n=21)	27% (n=45)	0.014*
Pain Intensity (0-5)	1.2±0.9 (n=437)	1.5±1.0 (n=134)	<0.001*	1.3±0.8 (n=35)	1.6±1.0 (n=99)	0.23
ODI-9 (%)	14.8±12.0 (n=416)	17.8±11.3 (n=130)	0.001*	18.6±9.1 (n=35)	17.5±12.1 (n=95)	0.38
PROMIS Pain Score	43.4±10.7 (n=1150)	45.4±10.9 (n=308)	0.005*	48.6±10.6 (n=67)	44.5±10.8 (n=241)	0.004*
PROMIS Mobility Score	53.2±8.8 (n=1140)	50.6±9.6 (n=308)	<0.001*	48.1±10.1 (n=67)	51.2±9.4 (n=241)	0.029*
PROMIS Anxiety Score	42.6±10.1 (n=1132)	43.1±10.5 (n=308)	0.59	41.9±10.1 (n=67)	43.4±10.6 (n=241)	0.37
Physical Therapy Order	17% (n=192)	44% (n=135)	<0.001*	61% (n=41)	39% (n=94)	0.001*

*p<0.05

Conclusion and significance

Back pain prevalence did not differ in children with hyperkyphosis than IS nor in SK than postural kyphosis. However, PRO scores were worse in hyperkyphosis and in SK. Higher PROMIS Pain and lower PROMIS Mobility scores only remained significant in the hyperkyphosis group after adjusting for confounding variables. Children with hyperkyphosis have worse PRO scores regardless of diagnosis subtype.

O15

RESPONSIVENESS OF PROMIS METRICS WITH THE EOSQ24 IN EARLY ONSET SCOLIOSIS

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Introduction

Health-related quality of life patient-reported outcome measures (PROM) in early onset scoliosis (EOS) are limited. The 24-item Early-Onset Scoliosis Questionnaire (EOSQ24) is a validated PROM evaluating the health status for children with EOS and caregiver burden. Patient Reported Outcome Measurement Information Systems (PROMIS) metrics have been extensively evaluated in children but have not been compared to the EOSQ24.

Objective (s)

To evaluate the PROMIS Pain Interference, Mobility, and Anxiety measures using the EOSQ24 as an anchor to determine the concurrent validity in children with EOS.

Study Design

Retrospective review

Methods

The charts of children with EOS who completed both the EOSQ24 and the PROMIS Pediatric Computer Adapted Test Pain Interference, Mobility, and Anxiety measures were retrospectively evaluated from April 2021 to June 2023. Comparisons were made according to each EOSQ24 domain and Total Score with Pearson correlations.

Results

A total of 236 children (84 boys, 152 girls) with EOS ages 10.4 ± 3.5 years (range: 5 - 19) with EOS were included. EOS subtypes were 33% idiopathic (n = 79), 31% congenital (n = 72), neuromuscular 19% (n = 45), and 17% syndromic (n = 40). Scoliosis primary curve magnitude averaged 39° ± 22°. EOSQ24 Total Score averaged 78.7 ± 17.4 out of 100 (Table). PROMIS Mobility scores indicated mild severity (44.1 ± 12.7), and PROMIS Pain Interference scores and Anxiety scores within functional limits (44.6 ± 10.0, 42.8 ± 9.8).

 Moderate, statistically and clinically significant associations were seen between PROMIS Mobility and EOSQ24 Total Scores (r = 0.75, p < 0.001), PROMIS Pain Interference and EOSQ24 Total Scores (r = -0.64, p < 0.001), and PROMIS Anxiety and EOSQ24 Total Scores (r = -0.50, p < 0.001, Table). The strongest correlations between the 3 PROMIS measures and each EOSQ24 domain were between Mobility and

EOSQ24 Physical Function (r = 0.75, p < 0.001), Pain Interference and EOSQ24 Pain/Discomfort (r = -0.68, p < 0.001), and Anxiety and EOSQ24 Emotion (r = -0.51, p < 0.001).

 Among the 37 children who completed the Oswestry Disability Index (ODI), the ODI Total Score also had a moderate association with the EOSQ24 Total Score (r = -0.70, p < 0.001). Increased curve magnitude had negative correlations with EOSQ24 Total Score (r = -0.45, p < 0.001, n = 200). There were no associations between the EOSQ24 Total Score and age, nor the EOSQ24 Total Score and body mass index.

EOSQ24 domain	EOSQ24 Average Score	Correlations (r)		
		PROMIS Mobility	PROMIS Pain Interference	PROMIS Anxiety
Total score	78.7±17.4	0.75	-0.64	-0.50
General health	77.4±18.3	0.35	-0.35	-0.32
Pain/discomfort	76.4±21.0	0.41	-0.68	-0.41
Pulmonary function	88.6±19.5	0.32	-0.39	-0.23
Transfer	86.0±23.5	0.56	-0.45	-0.32
Physical function	79.1±28.4	0.75	-0.50	-0.33
Daily living	69.1±32.6	0.71	-0.40	-0.33
Fatigue/energy level	76.1±24.6	0.46	-0.43	-0.38
Emotion	79.3±22.4	0.43	-0.54	-0.51
Parental impact	80.1±21.4	0.61	-0.54	-0.43
Financial impact	81.6±24.7	0.36	-0.27	-0.31
Satisfaction	74.7±24.5	0.67	-0.48	-0.35

Conclusion and significance

Worse PROMIS Mobility scores, worse PROMIS Pain Interference scores, and worse PROMIS Anxiety scores correlate with worse EOSQ24 scores. The associations were moderate (PROMIS Mobility [r = 0.75], PROMIS Pain [r = -0.64], PROMIS Anxiety [r = -0.50]). The PROMIS Mobility, Pain Interference, and Anxiety metrics demonstrate adequate responsiveness with the EOSQ24, supporting the use of the PROMIS metrics as condition-specific measures in EOS.

O16

PROMIS AND ODI TOOLS: CLINICALLY USEFUL PREDICTORS OF ABNORMAL MRIs IN PEDIATRIC BACK PAIN?

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Introduction

Back pain is growing in prevalence in adolescents, and MRIs are increasingly ordered to elucidate an underlying cause which can strain resource utilization. The usefulness of patient reported outcome measures (PROMs) to help providers determine whether to order an MRI is unknown.

Objective (s)

We hypothesize that the Patient-Reported Outcomes Measurements Information System (PROMIS) and Oswestry Disability Index (ODI) tools may help predict abnormal MRIs in adolescents with back pain.

Study Design

Retrospective case series

Methods

Retrospective review of 300 children (100M, 200F) ages 5-18 years, presenting with caregiver-reported back pain, who underwent spine MRIs, and who had completed 1) the PROMIS Pediatric Computer-Adapted-Test Pain Interference (PI), Mobility, and Anxiety measures, 2) the 9-item ODI, and 3) back pain intensity on a scale of 0-5, from April 2021 to June 2023. Patients were excluded if they had non-idiopathic scoliosis, previous spinal surgeries, or specifically neck pain. MRIs were categorized between abnormal versus normal. Abnormal MRIs included any findings that were clinically correlated with back pain or were the primary cause of back pain. Findings were determined by a board-certified radiologist and when positive findings were noted, secondarily verified by a board-certified orthopedic surgeon. PROMs were compared in both normal and abnormal MRIs (defined by presence of correlative and/or causative findings) with Mann-Whitney tests and logistic regression analyses. PROMIS and ODI score thresholds were determined with abnormal MRIs via ROC analyses.

Results

174 children had normal (59%) and 126 had abnormal MRIs. Average overall scores were PROMIS Mobility Mild severity (41.3±8.7), Pain moderate severity (57.5.±8.4), Anxiety within functional limits (47.1±10.9), ODI Percentage moderate disability (25.0±16.8), and back pain intensity (1.7±1.1 out of 5).

Lower PROMIS Mobility scores (OR 0.951; 95% CI 0.923-0.978) and higher ODI percentage (OR 1.015; 95% CI 1.001-1.029) were associated with abnormal MRI findings. There were no associations between PROMIS anxiety, PROMIS PI, and pain intensity with abnormal MRI findings (Table). A PROMIS Mobility threshold of 40.5 (AUC = 0.64) and ODI percentage of 21.1 (AUC = 0.58) were associated with abnormal MRIs.

Table - MRI Findings and PROMs

	MRI Findings						
Measure (mean score)	Normal* (n=174)	Abnormal Spine (Correlative + Causative, n = 122)	p-value (abnormal spine vs normal)	Spine Causative (n = 94)	p-value (spine causative vs. normal)	Spine Correlative (n = 28)	p-value (spine correlative vs. normal)
PROMIS Mobility	42.8 ± 8.6	39.2 ± 8.7	0.001*	39.3 ± 9.0	<0.001*	38.7 ± 7.8	0.014*
PROMIS Pain	56.9 ± 8.7	58.3 ± 7.8	0.13	58.3 ± 8.1	0.15	58.2 ± 6.8	0.43
PROMIS Anxiety	47.7 ± 11.4	46.3 ± 10.2	0.40	46.9 ± 10.1	0.73	44.4 ± 10.5	0.17
ODI Percentage	23.3 ± 16.5	27.4 ± 17.1	0.015*	27.6 ± 17.2	0.018*	26.8 ± 17.0	0.24
Pain Intensity	1.6 ± 1.1	1.8 ± 1.2	0.32	1.8 ± 1.2	0.21	1.6 ± 1.0	0.90

*P < 0.05. MRI was considered normal if there were no findings (n=158), incidental findings of the spine (i.e., Hemangioma, n=5), or incidental findings of the non-spine regions (i.e., kidney cyst) (n=11). Abnormal spine findings (n =122) included those correlated with back pain (i.e., Schmorl's) and those that are causative (i.e., disc herniation). Abnormal non-spinal findings (n =4) also included those correlative (i.e., ovarian cysts) and causative (i.e., pancreatitis).

Conclusion and significance

Many patients received unnecessary diagnostic imaging, since over 50% of patients with back pain had normal MRIs. Lower PROMIS Mobility and higher ODI scores, both indicative of higher functional disability, were associated with abnormal spinal MRIs. PROMIS PI and Pain Intensity were not associated with abnormal MRIs.

Therefore, "what you see is more important than what you hear". Decreased mobility and increased disability are more indicative of abnormal MRI findings than pain interference and intensity. In conjunction with a thorough history and physical exam, PROMIS Mobility and ODI tools may aid clinical decision making on the utility of MRIs in pediatric back pain.

O17

IMPACT OF SURGICAL TREATMENT FOR ADOLESCENT IDIOPATHIC SCOLIOSIS ON MATERNAL AND OBSTETRIC OUTCOMES: A META-ANALYSIS

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Introduction

The impact of adolescent idiopathic scoliosis (AIS) surgery on maternal and obstetric health outcomes remains unclear. Fusion surgery can affect vertebral mobility, pelvic mechanics, and the ability of the spine to support the weight and pressure exerted during pregnancy.

Objective (s)

To compare the maternal and obstetric health outcomes between pregnant AIS patients treated surgically (AIS surgery), pregnant AIS patients treated conservatively (AIS conservative), and pregnant healthy controls.

Study Design

This study was a systematic review and meta-analysis.

Methods

A systematic review and meta-analysis were conducted according to the PRISMA guidelines. PubMed, EMBASE, Scopus, and Cochrane Collaboration Library databases were searched for relevant studies. The risk ratios (RR) and mean differences (MD) were calculated for dichotomous and continuous variables. Heterogeneity was assessed using the chi2 and I2 tests. A fixed-effects or random-effects model was used based on heterogeneity results.

Results

Nine studies involving 4718 women were included. The frequency of caesarean section was higher in the AIS surgery group than in the healthy controls (RR 1.54, 95% CI 1.19 to 1.99), but not compared to the AIS conservative group (RR 1.28, 95% CI 0.96 to 1.69). Patients in the AIS surgery group were more likely to receive general anesthesia during caesarean section than were healthy controls (RR 11.69, 95% CI 3.03 45.13). Patients in the AIS surgery group reported more back pain during pregnancy than healthy controls (RR 4.02, 95% CI 1.20 to 13.49), but not compared to the AIS conservative group (RR 0.81, 95% CI 0.58 1.15). The AIS surgery group had worse scores on the SRS-22 pain and function domains than the

healthy controls. There were no differences in marital status or the number of children between the groups.

Conclusion and significance

Pregnant AIS patients treated surgically may have a higher risk of caesarean section and more back pain during pregnancy compared to healthy controls. The AIS surgery group also had worse scores on the SRS-22 pain and function domains than the healthy controls. However, there were no differences in marital status or number of children between the groups.

O18

IT IS ALL ABOUT PERSPECTIVES – LEVEL OF AGREEMENT BETWEEN THE PATIENT AND THEIR PARENT AND PHYSICIAN IN PERCEPTION OF SPINAL APPEARANCE IN ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

Adolescent idiopathic scoliosis (AIS) is a 3D-deformity of the trunk and spine and can affect the physical appearance of the AIS patient. The Spinal Appearance Questionnaire (SAQ) is an adequate instrument to measure the perception of appearance in patients with AIS. The appearance domain of this questionnaire includes illustrations of physical appearances, whereby the answer options show varying severities of the deformity. However, the SAQ can be challenging for patients, because not all parts of the deformity are visible to them (i.e. rib hump). Proxy ratings of their parent/caregiver or threating physician, who represent their perception, can be a potential alternative.

Objective (s)

To investigate whether perceptions of physician, parent or caregiver agree with the patient's perception of appearance, measured with the SAQ

Study Design

Multicenter, cross-sectional study

Methods

The Dutch SAQ was administered to 113 AIS patients (aged 15.4 years [SD 2.2], 78.8% girls), their parent/caregiver and their physician (n=15) in four hospitals in the Netherlands. Parents/caregivers completed the SAQ twice, based on their own perception (parent perspective) and their child's perception (parent-patient perspective). No special proxy versions were developed in this study. For all four perspectives (patient, parent, parent-patient and physician), the appearance domain scores were calculated. The Appearance domain consists of ten items, scored from 1 (best) to 5 (worst). Scores for the appearance domain range from 10 to 50. The level of agreement between the patients' perceptive and their three proxy's perspectives (parent, parent-patient and physician) was evaluated with intraclass correlation coefficients (ICC: two-way mixed effects, single measurement, absolute agreement [ICC <0.50 'poor'; ICC 0.50-0.75 'moderate'; ICC 0.75-0.90 'good' and ICC >0.90 'excellent' reliability]).

Results

The median appearance domain scores were 20.0 (11.0-33.0) for the patient, 20.0 (10.0-43.0) for the parent, 20.0 (10.0-41.0) for the parent-patient and 20.0 (12.0-38.0) for the physician perspective. The ICC (compared with the patient perspective) was 0.63 (95%CI 0.47–0.75) for the parent perspective, 0.60 (95%CI 0.45–0.71) for the parent-patient perspective and 0.43 (95%CI 0.27-0.57) for the physician perspective. The scatter plot shows the appearance domain scores of the patient and physician for each patient.

Appearance domain scores of the patient and physician for each patient

Conclusion and significance

The scores for the appearance domain were comparable between the four different perspectives (median groups scores). Nonetheless, the scores vary between the perspectives when looking at the individual cases. Hence, moderate agreement was found between the patient and the parent and parent-patient perspective, and poor agreement was found between the patient and the physician perspective. Therefore, we do not recommend the use of proxy ratings instead of the patient's rating. Physicians should be aware of the differences in perception of appearance and the possible effect on quality of life of the AIS patients.

O19

EFFECTS OF SPECIFIC EXERCISE THERAPY ON ADOLESCENT PATIENTS WITH IDIOPATHIC SCOLIOSIS: A PROSPECTIVE CONTROLLED COHORT STUDY

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Introduction

Early conservative treatment is helpful for IS. In addition to bracing, current evidence suggests that exercise can play an important role.

Objective (s)

The aim of this study was to explore the interventional effect of exercise therapy on idiopathic scoliosis (IS) and identify an optimal intervention window.

Study Design

A prospective controlled cohort study.

Methods

We included 99 patients with IS who were treated at the Guangdong Xinmiao Scoliosis Center from August 2013 to September 2017. The inclusion criteria were: new IS diagnosis, Cobb angle 10° to 25°, Risser 0 to 3 grade, only treated with the Xinmiao treatment system (XTS; >3 days/week, >1 h/day), and follow-up >1 year. Patients were divided into three age groups: A, <10 years (n=29); B, 10 to 12 years (n=24); and C, 13 to 15 years (n=46). The percentages of curve improvement (Cobb angle decrease ≥5°), stability (Cobb angle change between ±5°), and progression (Cobb angle increase ≥5°) were compared.

Results

The groups showed significant differences for major curve correction, Risser sign, first referral, and final follow-up of the main curve (all $P < 0.05$). The major curve in group A decreased significantly by 6.88 (44% correction), compared to 3.18 (18% correction) and 1.58 (9% correction) in groups B and C, respectively. In group A, 69.0% (20/29) had curve improvement, 27.6% (8/29) stabilized and 3.4% (1/29) progressed. In group B, 45.8% (11/24) improved, 50% (12/24) stabilized, and 4.2% (1/24) progressed. In group C, 26.1% (12/46) improved, 63.0% (29/46) stabilized, and 10.9% (5/46) progressed. There was also a significant difference in final Risser grade among the groups ($P < 0.05$).

Conclusion and significance

For IS patients with Cobb angles between 10° and 25°, our exercise protocol can effectively control or improve curve progression. Younger patients with a lower Risser grade are most likely to respond.

O20

EFFECT OF SPECIFIC EXERCISE THERAPY IN THE TREATMENT OF SKELETALLY IMMATURE IDIOPATHIC SCOLIOSIS

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Introduction

Skeletally Immature patients with mild Idiopathic Scoliosis may be progressive，specific exercise therapy helps to control the progression，however the research on this topic is still limited.

Objective (s)

This study aims to evaluate the effect of specific exercise therapy in the treatment of skeletally immature idiopathic scoliosis (IS).

Study Design

A retrospective study.

Methods

A total of 51 IS patients, 19 males and 32 females, who were admitted to the Guangdong Xinmiao Scoliosis Prevention Center from October 2017 to September 2021 were included. Inclusion criteria were as follows: 1) treatment-naive patients diagnosed with IS for the first time; 2) Cobb angle of the major curve between 10° to 25°; 3) Risser sign grade 0-2 at the time of treatment; 4) being treated with specific exercise therapy alone for > 3 days a week and > 1 hour a day; and 5) follow-up for at least 1 year. Patients were divided into two groups according to whether the triradiate cartilage was closed: open triradiate cartilage group (n = 32) and closed triradiate cartilage group (n = 19). Scoliosis correction in all patients was assessed using the following criteria: improvement (decrease in the major curve Cobb angle of ≥5°), stabilization (change in the major curve Cobb angle between -5° and 5°), and progression (increase in the major curve Cobb angle of ≥5°).

Results

The average age of 51 IS patients at the time of treatment was 10.2±2.3 years. After 26.5±9.8 months of treatment, the Cobb angle of the major curve was corrected from an average of 15.5°±4.2° to 11.3°±6.7°, with an average correction of 4.5°±5.7°. Among them, 58.9% (30/51) patients achieved improvement in the major curve Cobb angle, 33.3% (17/51) achieved stabilization, and 7.8% (4/51) progressed. There was no significant difference in the major curve Cobb angle between the closed and

open triradiate cartilage groups before treatment (p = 0.472), whereas there was a significant difference in the correction of the major curve after treatment (p = 0.022).

Conclusion and significance

Specific exercise therapy effectively prevents the progression or corrects the scoliosis in patients with skeletally immature idiopathic scoliosis with a Cobb angle between 10° and 25°. Moreover, it is significantly more effective in patients with open triradiate cartilage than in those with closed triradiate cartilage.

O21

A RETROSPECTIVE STUDY OF PHYSIOTHERAPY SCOLIOSIS SPECIFIC EXERCISES WITH AND WITHOUT BRACING

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Introduction

Physiotherapy Scoliosis specific exercises (PSSE) are used in the conservative treatment of idiopathic scoliosis to decrease progression of the curve, decrease pain, improve aesthetic appearance of trunk deformities and increase strength.

Objective (s)

The objective of this retrospective study was to determine if patients with idiopathic scoliosis followed at a tertiary medical center using non-operative management had progression of their curves after receiving PSSE with or without bracing.

Study Design

Retrospective cohort study

Methods

This is a retrospective cohort study that included individuals who received PSSE at a tertiary level academic medical center. Patients who received PSSE with or without bracing were identified for analysis. IRB approval was obtained. Continuous variables were summarized using means, standard deviations, and ranges. Comparisons between groups were performed using Wilcoxon rank sum tests for continuous variables and Fisher's exact tests for categorical measures.

Results

There were 59 patients whose charts were reviewed as part of the retrospective analysis. Of these 53 (89.9%) were female and 6 (10.2%) were male. The mean age of patients at evaluation was 12.9 +/- 2.1 years (9.0-17.2). The mean number of physiotherapy visits was 12.7 +/- 5.8 and visits occurred over 7.7 +/- 5.5 months. Of the 59 patients who received PSSE, 19 did not receive a brace and 40 received PSSE and bracing. More patients who received a brace had two curves 27 (67.5%) compared to 8 (42.1%) patients who were not braced however this was not statistically significant (p>0.05). Patients who were braced reported statistically significant improvements in back pain as reported via numeric rating scale (NRS) (p<0.001) while and not braced did not report statistically significant improvements (p=0.05) (see Table 1). Additionally, all patients who completed PSSE demonstrated improvements in lower abdominal strength and lower trapezius strength. Neither group demonstrated a mean progression of

Cobb angle but there was no significant difference in reduction of Cobb angle for either the brace or no brace groups. See table 1 for outcomes.

Table 1. Brace vs No Brace Outcomes					Brace Difference vs No Brace P-value
Brace Outcomes	Measurement at Evaluation Mean ± sd (range) n	Measurement at Discharge Mean ± sd (range) n	Difference = discharge – eval Mean ±sd (range) n	P-value (Difference ne 0)	
Primary Cobb angle degree Brace No Brace	29.2 ± 8.7 (16.0 - 54.0) 40 23.2 ± 10.0 (10.0 - 46.0) 19	30.8 ± 13.4 (8.0 - 69.0) 39 23.5 ± 12.0 (10.0 - 46.0) 17	1.5 ± 9.1 (-18.0 - 23.0) 39 -0.3 ± 5.4 (-6.0 - 13.0) 17	0.30 0.40	0.27
Secondary Cobb angle degree Brace No Brace	26.6 ± 7.1 (15.0 - 43.0) 27 26.5 ± 11.7 (10.0 - 51.0) 8	26.6 ± 10.2 (10.0 - 55.0) 30 27.0 ± 12.9 (12.0 - 51.0) 8	1.2 ± 7.1 (-14.0 - 15.0) 26 0.0 ± 5.8 (-9.0 - 10.0) 7	0.39 1.0	0.68
Back Pain (0-10) Brace No Brace	1.6 ± 2.2 (0.0 - 7.0) 40 1.0 ± 1.7 (0.0 - 5.0) 19	0.2 ± 0.5 (0.0 - 2.0) 40 0.1 ± 0.2 (0.0 - 1.0) 19	-1.5 ± 2.1 (-7.0 - 0.0) 40 -0.9 ± 1.7 (-5.0 - 1.0) 19	<0.001 0.05	0.41
Scoliometer degree Brace No Brace	8.4 ± 3.8 (3.0 - 17.0) 40 7.7 ± 2.7 (4.0 - 15.0) 19	8.2 ± 3.9 (2.0 - 20.0) 40 7.4 ± 3.6 (4.0 - 15.0) 19	-0.3 ± 3.3 (-12.0 - 10.0) 40 -0.3 ± 2.4 (-5.0 - 5.0) 19	0.71 0.51	0.35
Lower abdominal strength Brace No Brace	6.9 ± 1.9 (3.0 - 9.0) 40 6.3 ± 1.4 (4.0 - 9.0) 19	3.7 ± 1.2 (1.0 - 6.0) 40 3.4 ± 1.1 (1.0 - 5.0) 19	-3.2 ± 1.7 (-6.0 - 0.0) 40 -2.9 ± 1.7 (-8.0 - 0.0) 19	<0.001 <0.001	0.37
Lower trapezius strength Brace No Brace	5.1 ± 1.5 (3.0 - 8.0) 29 4.9 ± 1.1 (3.0 - 6.0) 11	3.4 ± 1.4 (1.0 - 7.0) 29 3.1 ± 1.2 (2.0 - 6.0) 10	-1.8 ± 1.7 (-6.0 - 1.0) 29 -1.8 ± 1.5 (-4.0 - 1.0) 10	<0.001 0.02	0.79

Conclusion and significance

There may be a slight improvement in primary curve for patients who received both PSSE and bracing and no progression of curve for patients who just received PSSE. Other outcomes such as back pain, lower abdominal strength and lower trapezius strength showed improvements with PSSE with bracing and without. Therefore, as previously reported PSSE with and without bracing is a helpful aspect of conservative management of AIS.

O22

THE EFFECTS OF SHORT- AND LONG-TERM SPINAL BRACE USE WITH AND WITHOUT EXERCISE ON SPINE, BALANCE, AND GAIT IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS

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Introduction

Adolescent idiopathic scoliosis (AIS) is a prevalent spinal disorder in adolescents. Previous studies have shown biomechanical changes of the gait in the lower limb of AIS patients. To minimize the progression of scoliotic curvature, a spinal brace is used, which has been shown to be efficient. Usually, a brace is worn strictly for 20-22 h every day. To our knowledge, no study has assessed the short- and long-term effects of spinal brace use with or without an exercise program (6 months) to improve clinical and biomechanical parameters.

Objective (s)

The aim of our study was to verify the effects of short- and long-term spinal brace use, with or without an exercise program on the spine, body balance, and plantar load distribution during gait in AIS.

Study Design

A prospective randomized study was conducted with intention-to-treat analysis in forty-five adolescents diagnosed with AIS undergoing conservative treatment at a center specialized in spinal rehabilitation.

Methods

Adolescents were evaluated at two stages of intervention: (1) spinal orthopedic brace, with acute use 24 h/day (*n* = 22) and (2) spinal orthopedic brace, with acute use between 15-18 h/day associated with a specific rehabilitation exercise protocol for six consecutive months (six months and 12 total sessions, *n* = 23). The evaluated parameters were: spine pain, using a visual analog scale (VAS); Cobb angle measurement using radiograph exams, as well as the Risser sign; and static balance and plantar pressure of the feet during gait, carried out using a pressure platform.

Results

AIS patients showed significant improvements in the main scoliotic curvature, with a 12-degree reduction in Cobb angle pre- and post-short-term immediate use of spinal brace and a 5.3 degree correction after six months of spinal brace use in combination with specific exercises (long term). In addition, short- and long-term brace use with an exercise program showed a significant increase in anteroposterior and mediolateral balance and a reduction in plantar overload on the heel during gait, with an effect size between moderate and high.

Conclusion and significance

Intervention via the short- or long-term use of a spinal brace combined with specific exercises in adolescents with idiopathic scoliosis proved to be effective for correcting scoliotic curvature. In addition, intervention also showed improvements to the antero-posterior and mediolateral body balance and a reduction in the plantar load on the rearfoot region during gait, demonstrating effective mechanical action on the spine.

O23

BEST PRACTICE FITNESS EXERCISE GUIDELINES FOR ADULTS WITH SPINAL DISORDERS: A DELPHI SURVEY

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Introduction

Adult Spinal Disorder (ASD), including scoliosis and hyper-kyphosis, is of growing interest in health care due to its prevalence in a population that has expanded because of increased longevity. This population is at risk for progression resulting in spine instability, pain and disability, which impacts quality of life. Research studies have identified several radiological indices (called modifiers) for patients with ASD that correlate with health-related quality of life measures. Modifiers may be used in conjunction with a physical examination focusing on gait, posture, and movement competence to establish risk stratification indicators for optimal treatment planning that includes fitness exercises. Fitness exercises can improve spine stability and protect against chronic disease. However, research on exercise for people with ASD has focused on Physiotherapy Scoliosis Specific Exercise (PSSE), not on exercise for fitness. Fitness exercise guidelines would benefit people with ASD and the professionals who coach them.

Objective (s)

The goal of this study is to use the Delphi process to obtain expert consensus for an algorithm using risk assessment for determining best practice fitness exercise guidelines for people with ASD.

Study Design

Delphi Study

Methods

A worldwide panel of 21 Physiotherapy Scoliosis Specific Exercise (PSSE) trained physical therapists completed a two-round Delphi survey to obtain consensus on whether and how the presence of modifiers should be considered in conjunction with movement competence to assess risk when choosing safe fitness exercise programs for persons with ASD. Answers and comments to multiple choice questions were analyzed and then translated into a fitness exercise algorithm for this population. Consensus was achieved when 70% of panel members agreed with statements about risk.

Results

https://www.stolzetherapies.com/fitness-algorithm-for-adult-spinal-disorder/

After 2 survey rounds, all 13 survey questions obtained at least a 70% agreement from 21 PSSE trained physical therapists from around the world, establishing a best practice fitness exercise algorithm for adults with spinal disorder.

Delphi Survey Results: ASD and Fitness Exercise

Item	Answer	% Agree
1. Do you support participation in Fitness Exercise for your patients with ASD?	Yes	100
2. Should you consider these radiological criteria when treating your patient with ASD?[1]	Yes	100
3. If yes, should these radiological criteria[2] inform your Fitness Exercise recommendation for the patient with ASD?	Yes	100
4. Should an adult with higher risk for spine instability (due to presence of these radiological criteria) be prescribed a Spine Stability Program instead of an Unrestricted Program?	Yes	100
5. If radiological information is not available, would it be reasonable to use these clinical tests[2] to help determine level of risk in ASD for pain, disability and spine instability?	Yes	100
6. Should your physical exam of the patient with ASD include an assessment of movement competence using either a formal or informal assessment?	Yes	100
7. Should therapists take movement competence into consideration when making fitness exercise recommendations?	Yes	100
8. Which fitness program should be recommended for the adult WITH RISK FACTORS for spine structural instability who is a challenged mover?	Spine Stability Program	95.2
9. Which fitness program should be recommended for the adult with NO RISK FACTORS who is a challenged mover?	Spine Unrestricted Program	71.4
10. Which fitness program should be recommended for the adult WITH RISK FACTORS for spine structural instability who is a competent mover?	Spine Stability Program	81
11. Which fitness program should be recommended for the adult with NO RISK FACTORS who is a competent mover?	Spine Unrestricted Program	95.2
12. Should a determination of Persistent Pain in a person with ASD - during a fitness assessment or at any time during participation in a fitness exercise program - signal the referral to a medical professional who specializes in ASD?	Yes	100
13. SOSORT recommends Sports/Recreation for patients with scoliosis. Do you support Sports/Recreation for your patients with ASD ?	Yes	95.2

[1]Schwab 2012 [2]Amatachaya 2016, Cote 1998, Grunstein 2013

Conclusion and significance

An algorithm was created from a consensus of experts to help guide fitness exercise selection for adults with ASD based on their level of risk for spine instability, pain and disability. In brief, we propose the following fitness exercise guidelines: 1) adults with persistent pain should consult a specialist in ASD prior to beginning a general fitness exercise program; 2) adults with modifiers verified radiographically or clinically should perform spine stability exercises; 3) adults without modifiers who lack movement competence should begin with spine stability exercises and may advance to unrestricted exercises if movement competence improves. This theoretical framework and algorithm will help guide safe fitness exercise choices for this population.

O24

IMPROVED EFFECTIVENESS OF SCOLIOSIS SPECIFIC PHYSIOTHERAPY BY INCREASING PARENTS' PARTICIPATION IN CONSERVATIVE TREATMENT

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Introduction

Scoliosis specific physiotherapy demonstrated efficacy in idiopathic scoliosis (IS) management however, the adolescent's compliance and adherence to the physiotherapy protocol remains a challenge. Active parental participation could possibly contribute to improve this limitation.

Objective (s)

Comparison of the effectiveness of specific in-patient physiotherapy performed with versus without presence of the parents/caregivers.

Study Design

Case-control study of two groups of adolescents having similar IS and treated using the same method by the same physio team but using two different protocols: one with (group I) versus one without (group II) parental assistance.

Methods

A total of 188 adolescent girls having IS were examined.

Group I: 96 girls, aged 13.4 (SD=1.8), group II: 92 girls, aged 13.9 (SD=1.8), all were admitted to an in-patient clinic for idiopathic scoliosis treatment.

At baseline group I vs. group II parameters revealed similar:
Thoracic Cobb = 29.8 degrees (SD=10.6) vs. 31.8 degrees (SD=12.4), p=0.24
Lumbar Cobb = 29.3 degrees (SD=10.0) vs. 28.6 degrees (SD=10.5), p=0.67
Thoracic ATR = 7.1 degrees (SD=4.0) vs. 7.3 degrees (SD=3.8), p=0.78
Lumbar ATR = 5.2 degrees (SD=4.4) vs. 4.6 degrees (SD=4.4), p=0.39

The number of brace-treated patients was the same 57 vs.57.
Duration of in-patient therapy was one week in the group I or two weeks in the group II.
Parental participation differed between the groups as follows: group I - permanent presence and parental education; group II - parental presence exclusively at admission and discharge.
Identical specific physiotherapy was applied in both groups by the same physio team.

Outcome measure: The ability to perform an active self-corrective movement, assessed by the improvement of POTSI surface parameter (Posterior Trunk Symmetry Index).
POTSI was measured twice on a trunk photograph taken at admission and at discharge, both photographs were taken using a digital camera in actively corrected standing position.

Results

The POTSI values for group I were: 23.5 (SD=12.2) at admission and 17.9 (SD=7.9) at discharge, $p<0.001$. For the group II: 22.4 (SD=11.4) and 23.2 (SD=11.3), respectively, p=0.44.

In the group I: 69 patients improved (mean POTSI improvement of 10.0) while 27 patients worsened (mean POTSI worsening of 5.7).

In the group II: 41 patients improved (mean POTSI improvement of 7.8) while 51 patients worsened (mean POTSI worsening of 7.8).

Conclusion and significance

Children treated for idiopathic scoliosis with specific physiotherapy can better perform the active self-corrective movement when their parents/caregivers assist at therapy and learn the exercises together with the children. This observation was made in spite of a shorter time of in-patient stay (one week) in this group of children.

O25

INDIVIDUALS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS PARTICIPATING IN PHYSICAL THERAPY SCOLIOSIS-SPECIFIC EXERCISE DEMONSTRATE IMPROVEMENT IN RIB CAGE MOBILITY AND HEALTH-RELATED QUALITY OF LIFE

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Introduction

Current research has demonstrated the benefit of physical therapy scoliosis-specific exercise (PSSE) on health-related quality of life (HRQoL) and respiratory function using spirometry, but little has been investigated regarding PSSE impact on rib cage mobility and diaphragmatic expansion.

Objective (s)

This study will examine how an individual's rib cage mobility and diaphragmatic expansion benefits from PSSE. It will also strengthen the body of literature supporting the relationship between PSSE and HRQoL.

Study Design

Retrospective chart review of prospectively collected data.

Methods

Patients were included if they were diagnosed with adolescent idiopathic scoliosis and received treatment through our PSSE program between 2017 and 2023. Subjects must have participated in PSSE led by one of three physical therapists who are BSPTS-certified at a hospital-based outpatient pediatric physical therapy clinic. Subjects' treatment plans were individualized and varied in the number of treatment sessions and length of care plan. Outcome assessments obtained at the PSSE evaluation (pre-treatment) were compared to assessments at the PSSE discharge (post-treatment). Paired sample t-tests were conducted using R version 4.3.1. to determine if there were significant differences between the following pre- and post-PSSE outcomes: rib cage mobility and diaphragmatic expansion at three different levels of the body (axilla, xyphoid process and waist); Scoliosis Research Society questionnaire (SRS-22r) total and its subdomains and the Trunk Appearance Perception Scale (TAPS).

Results

Ninety-one individuals met inclusion criteria. Age range was 10-18 years old. Cobb angles were >15 degrees with the largest curve of any individual being 48 degrees. Brace wear and HRQoL survey completion varied within the group. Statistically significant (p<0.01) improvements were observed when comparing pre- to post-treatment outcomes of rib cage mobility, diaphragmatic expansion, SRS-22r subdomains of self-image, patient satisfaction, and total scores . Statistically significant (p<0.05)

improvements were observed in the SRS-22r subdomain of pain. Statistical significance was not met in the SRS-22r subdomains of function, mental health and the TAPS. (Table 1)

Table 1: Pre- to Post- Treatment Outcome Results

Results for mobility during respiration	N	Evaluation Mean in cm (SD)	Discharge Mean in cm (SD)	% of patients with improvement	p-value *indicates significance
Axilla	91	2.68 (1.269)	3.72 (1.378)	68%	<0.01*
Xyphoid	91	3.03 (1.571)	4.02 (1.575)	71%	<0.01*
Waist	91	1.20 (0.961)	2.92 (1.264)	87%	<0.01*
Results for HRQoL surveys	N	Average score at evaluation (SD)	Average score at discharge (SD)	% improvement of patient scores	p-value *indicates significance
SRS-22r total	90	4.21 (0.397)	4.39 (0.578)	69%	<0.01*
SRS-22r function	89	4.63 (0.432)	4.66 (0.377)	35%	0.518
SRS-22r pain	90	4.42 (0.629)	4.55 (0.428)	37%	<0.05*
SRS-22r self-image	90	3.89 (0.576)	4.06 (0.559)	50%	<0.01*
SRS-22r mental health	90	4.13 (0.651)	4.18 (0.664)	46%	0.318
SRS-22r Satisfaction	86	3.61 (0.802)	4.4 (0.588)	71%	<0.01*
TAPS	71	3.81 (0.746)	3.95 (0.515)	35%	0.055

Conclusion and significance

Results from this study demonstrate statistically significant improvements in rib cage mobility and diaphragmatic expansion. In addition, this study demonstrates that PSSE does have a positive and statistically significant impact on an individual's HRQoL, which is consistent with prior literature and agreed upon to be an important factor in one's health outcomes. In a population that requires bracing for curve management that may result in restriction of rib cage mobility and diaphragmatic expansion, PSSE is useful for improving breathing mechanics and flexibility for the respiratory system to optimally function.

O26

REPORTING EXERCISE COMPLIANCE IN STUDIES INVESTIGATING PHYSIOTHERAPEUTIC SCOLIOSIS SPECIFIC EXERCISE IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS: A SCOPING REVIEW

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Introduction

Recommended non-surgical management of Adolescents with Idiopathic Scoliosis (AIS) includes Physiotherapeutic Scoliosis Specific Exercise (PSSE). While recommendations are widely accepted, a study investigating long-term compliance with a PSSE program has demonstrated, for the first time, a general trend for decreased participation in prescribed PSSE home exercise programs (HEP) over time. This presents challenges in determining efficacy of PSSE in AIS, creating uncertainty for therapists prescribing HEPs in the real-world. Studies report poor compliance results in suboptimal clinical effect; however, parameters that define PSSE compliance in AIS, motivational strategies to increase compliance, and the real-world impact on treatment prescription and modification is unknown. Furthermore, when compliance is mentioned in PSSE studies, seldomly is it factored into any treatment modifications or study results.

Objective (s)

To gain an understanding of consistency in the reporting of compliance in studies investigating PSSE in AIS and to identify motivational strategies employed to successfully enhance compliance to these programs.

Study Design

Scoping Review

Methods

A scoping review of the literature was conducted, guided by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR). To synthesise original research, PubMed, CINAHL, and EMBASE databases were searched from inception to October 2023 and reference lists were examined for studies reporting compliance, adherence, or motivational strategies for PSSE in AIS.

Results

Fifteen articles were included with a focus on PSSE in AIS. Studies were selected for data extraction after abstract and full-text screening by two independent reviewers (AF and RM). This review indicates that compliance (C) and adherence (A) are terms used interchangeably (C: 47%; A: 40%; both: 13%) and

stated inconsistently through various parts of a paper, half of investigators clearly define compliance and/or adherence (defined: 53%; undefined: 47%), and some employ strategies to enhance compliance/adherence (strategy: 67%; no strategy reported: 33%). Compliance/adherence was often not reported in the results (not reported: 67%; reported: 33%), or reflected in the discussion of results (discussed: 13%; not discussed: 87%).

Conclusion and significance

Compliance and/or adherence are mentioned within multiple studies investigating efficacy of PSSE in AIS; however, our analysis suggests: 1) variations in the section of the paper in which compliance/adherence is mentioned, 2) variations in whether the inclusion criteria hinged on patient compliance, 3) variations in whether motivational strategies were used and reported, 4) variations in whether the impact of motivational strategies on outcomes was reported, and if so, whether treatment was adapted, and 5) most notable was the lack of compliance or adherence reporting in results and discussion sections. The definition of appropriate compliance, and any effective motivational strategies to improve compliance, of PSSE in AIS to achieve maximum, or even minimum, desired results for treatment of AIS remains undetermined.

O27

INFLUENCE OF SCHROTH BEST PRACTICE THERAPY ON VENTILATORY FUNCTION IN ADOLESCENT IDIOPATHIC SCOLIOSIS: RANDOMIZED CONTROLLED STUDY DESIGN

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Introduction

adolescent idiopathic scoliosis, is a complicated 3D trunk deformation that affects 2-4% of the population. Only 8–9% of patients with AIS will benefit from bracing, whereas 0.1% will require spinal instrumentation as well as fusion surgery.

about 2/3 of people with sufficiently developed scoliotic curves also have a restricted pattern of respiratory problems, making scoliosis a major health issue both locally and globally.

Objective (s)

To find out the efficacy of Schroth Best Practice therapy on pulmonary functions in adolescent idiopathic scoliosis.

Study Design

Sixty female subjects with adolescent idiopathic scoliosis were recruited from AlKasr Al-Ainy Hospital. They were randomized into two equivalent groups: Group A (Study group) consists of 30 subjects received the Schroth Best Practice exercises program for 18 weeks, the control group B: consists of 30 subjects received traditional exercise program for 18 weeks. Both groups were given 3 sessions a week and received assessment of pulmonary functions: Forced Vital Capacity (FVC), forced expiratory volume in the first second (FEV1) As well as Peak Expiratory Flow (PEF) on 1st and 18th week with digital handheld spirometer.

Methods

Group A will receive Schroth Best Practice exercises which consists of: Self-Correction exercises and Rotational Angular Breathing exercises.
 Group B will receive Traditional exercises which consists of: stretching of the concave side and strengthening of the convex side, Hanging on wall Bar and electrical stimulation
 Patients in both groups were given the treatment program three times per week for 18 weeks.
All the patients were cooperative throughout the treatment program, As well as the adherence rate was about 97%.

The findings of the Shapiro-Wilk test showed that the FVC, FEV1, as well as PEF values were normally distributed. Therefore, we utilized a 2×2 mixed design MANOVA for comparing the tested variables of interest across groups and time periods.

Results

FVC	Pre test Mean± SD	Post test Mean± SD	MD	% of change	p- value
Group A	61.2±7.84	73.69 ±4.64	-12.69	20.4	0.0001*
Group B	60.78 ±3.08	69±3.71	-8.22	13.52	0.0001*
MD	0.42	4.69			
p- value	0.789	0.0001*			

FEV1	Pre test Mean± SD	Post test Mean± SD	MD	% of change	p- value
FEV 1 Group A	64.91±4.02	78.49 ±4.1	-13.58	20.92	0.0001*
FEV 1 Group B	62.8 ±4.84	69.23±5.03	-6.43	10.23	0.0001*
MD	2.11	9.26			
p- value	0.072	0.0001*			

PEF	Pre test Mean± SD	Post test Mean± SD	MD	% of change	p- value
Group A	60.59±3.5	76.93 ±2.03	-16.34	26.96	0.0001*
Group B	58.97±5.76	66.3±6.12	-7.33	12.43	0.0001*
MD	1.62	10.63			
p- value	0.193	0.0001*			

There was a statistically significant difference ($p<0.05$) among the two groups when comparing the mean values of all measured variables pre and post treatment. All analyses were performed at the 0.05 level of significance. With the initial alpha level set at 0.05, in favor of group A. with confidence interval 95%.

Conclusion and significance

The change percentage in FVC before and after intervention in Group A was (20.4%), in Group B before and after intervention was (13.52%); and in FEV1 before and after intervention in Group A was (20.92%), in Group B before and after intervention was (10.23%); And in PEF before and after intervention in Group A was (26.96%), in Group B before and after intervention was (12.43%);

The findings of this study showed that SBP exercise program was more effective as it provide self-correction improve postural feeling with improvement in body awareness and Rotational Angular Breathing enhances rib mobility and breathing pattern.

O28

SCHROTH CURVE TYPES PRESENT DIFFERENT BASELINE VALUES BUT SIMILAR CHANGES IN PATIENT-REPORTED OUTCOMES – A SECONDARY DATA ANALYSIS OF THE SCHROTH EXERCISE TRIAL FOR ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS).

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Introduction

Scoliosis-specific exercises (SSE) are prescribed depending on a curve pattern. The Schroth approach has positive effects on patient reported outcome measurements (PROMs). Clinicians can reliably classify Schroth curve patterns into T-type (major thoracic) without, and THS with pelvic imbalance, and L-type (major lumbar), LHS-types with pelvic imbalance.

Objective (s)

To compare PROMS and weight asymmetry among the Schroth curve type subgroups receiving a six-month Schroth scoliosis-specific exercise intervention.

Study Design

Secondary data analysis of a Schroth RCT comparing curve type subgroups before and after a 6-month intervention.

Methods

Patients aged 10 to 17 years old with AIS and not previously treated were recruited consecutively from a scoliosis clinic. At baseline and 6months, the weight distribution asymmetry was recorded between the left and right foot in habitual standing. Schroth curve type was identified using an algorithm by an evaluator blinded to exercise participation. The Spinal Appearance and the SRS-22r questionnaires were completed on paper or using online using REDCAP survey as preferred. Participants were asked for 6 months of weekly supervised exercises and 30-40 minutes of 3-4 home exercises selected using an algorithm. Those meeting the SRS criteria also received a rigid brace. Mixed-model ANOVA were used to compare PROMs and weight asymmetry results.

Results

Of 128 participants with mean age 13±2.1years, 51 were T-types, 15 without and 36 with pelvic imbalance, 77 L-types (15 without and 62 with pelvic imbalance. Five were males. Most curve type changes during treatment occurred from THS to LHS- or T-type (4 each) or from LHS to L-type (n=8).

Abstracts

Weight distribution asymmetry did not change with treatment. T-types bore more weight on the right and L-types on the left.

There were no changes detected in SAQ scores over time in any curve type (time and interactions not significant). SAQ prominence scores were worse in TH-types compared to T-type. Trunkshift, Appearance and Total scores were better in T-type compared to TH-types. Waist was better in T-type compared to LH-types. Shoulders and Expectation scores were better in T-type compared to all L-types. The were no differences detected in SAQ Curve, Kyphosis, and Chest scores.

For the SRS-22r, there were no differences in function. Significant improvements in Pain, Mental health, Satisfaction and Totals scores were observed after treatment in all curve types (Time p<0.05, interaction ns). LH-types had worse Selfimage, Mental Health and Total scores than T-Types. TH- and LH-types had worse pain scores than L-types.

Table 1: Comparison of outcomes from pre to post -exercise for each curve types.

Variables	T		TH-Types		L		LH-types		ANOVA Interaction, time, type if p<0.10
	PRE	POST	PRE	POST	PRE	POST	PRE	POST	
Weight asymmetry (%)	-1.7±6.3	-0.3±4.8	1.5±8.2	1±7.8	-1.4±4.1	-1.8±4.6	-4.5±6.9	-3.3±7.1	Type p=0.002 3CP R vs 4CP L
SAQ General /15	5.3±2.5	6±2.8	7.8±3.6	6.9±3.2	7.6±3.2	7.8±3.6	7.9±2.9	8.3±3	Type p=0.076 3c < 4cp
SAQ Curve /5	1.8±0.6	1.7±0.5	2.3±0.8	2.1±0.6	1.9±0.6	2±0.5	2.1±0.6	2.1±0.6	
SAQ Prominence /10	3±1.1	2.8±1	3.9±1.6	3.8±1.2	2.9±0.7	3.1±1	3.5±1.3	3.6±1.3	Type p=0.042 3c+4C < 3cp
SAQ Trunkshift /10	2.7±0.8	3.2±1.1	4±1.9	3.7±1.1	2.9±0.9	3.4±1.3	3.8±1.2	3.8±1.3	Type p=0.05 3C < 3CP+4CP
SAQ Waist /15	3.8±1.8	5.3±3.6	7.3±4.6	6.7±4.2	7.1±5.5	8.5±5.5	7.7±4.5	7.9±4.3	Type p=0.091 3c < 4cp
SAQ Shoulders /10	3.5±1.7	3.9±1.4	4.8±1.7	4.5±2	5.3±1.9	5.1±2.2	5±1.9	5±1.9	Type p=0.089 3C < 4C+4CP
SAQ Kyphosis /5	1.3±0.5	1.4±0.5	1.6±1.1	1.7±0.7	1.6±0.5	1.7±0.5	1.6±0.8	1.5±0.6	
SAQ Chest /10	2.5±1.3	2.7±1.4	4.2±2.9	3.5±2.3	4.7±3.7	5.5±3.9	4.4±3	4.6±2.9	
SAQ Appearance /35	10.3±2.4	10.9±2.3	13.8±5.5	13.2±3.8	11.1±2	12±3.2	12.9±3.7	13±3.5	Type p=0.057 3C < 3CP+4CP
SAQ expectations /20	6.8±3.5	8.9±4.8	11.3±6.1	10.4±5.4	11.7±6.2	12.8±6.7	12.1±5.5	12.4±5.2	Type p=0.052 3C < 4C+4CP
SAQ Total /55	17.1±4	19.8±5	25.2±8.8	23.6±8.6	22.8±6.6	24.8±8.9	25±7.5	25.4±7.6	Type p=0.040 3C <3CP+4CP
SRS22r Function /5	4.8±0.3	4.8±0.2	4.6±0.4	4.6±0.4	4.8±0.3	4.8±0.2	4.7±0.4	4.7±0.4	
SRS22r Pain /5	4.5±0.5	4.7±0.4	4.3±0.6	4.6±0.5	4.7±0.4	4.9±0.2	4.4±0.5	4.5±0.5	Time p<0.001 Type p=0.051 3CP+4CP<4C
SRS22r Selfimage /5	4.5±0.5	4.4±0.4	4±0.7	4.1±0.7	4.1±0.7	4.2±0.5	3.8±0.6	3.9±0.6	Type p=0.008 4CP<3C
SRS22r Mental health /5	4.4±0.5	4.7±0.3	4.3±0.6	4.3±0.6	4.1±0.6	4.3±0.4	4.1±0.6	4.1±0.6	Time p=0.023 Type=0.091 4CP<3C
SRS22r Satisfaction /5	3.9±0.8	4.6±0.8	4±0.7	4.3±0.6	3.8±0.6	4.5±0.6	4±0.8	4.3±0.6	Time p <0.001
SRS22r Total /5	4.5±0.4	4.7±0.3	4.3±0.4	4.4±0.4	4.4±0.4	4.6±0.2	4.2±0.3	4.3±0.4	Time p<0.001 Type p=0.015 4CP<3C

Conclusion and significance

This study supports using Schroth curve types for subgroup analysis. While curve types with pelvis asymmetries were most severely affected based on quality of life and perceived appearance scores, all curve types experienced improvements in SRS22r Pain, Mental Health, Satisfaction and Total scores. Tools with better sensitivity to change may detect more differences.

O29

IS SCHROTH METHOD EFFECTIVE TO IMPROVE THE COBB ANGLE, QUALITY OF LIFE AND TRUNK ROTATION ANGLE IN ADOLESCENT IDIOPATHIC SCOLIOSIS? A SYSTEMATIC REVIEW AND META-ANALYSIS.

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Introduction

One of the most used treatments in adolescent with idiopathic scoliosis (AIS) is the Schroth method. Is based in three-dimensional correction combining sensorimotor, postural, and corrective breathing exercises.

Objective (s)

This systematic review and meta-analysis aimed to analyse the effects of the Schroth method in isolation on Cobb angle, quality of life, and trunk rotation angle compared to no intervention or other conservative treatments in patients with AIS.

Study Design

A systematic-review and Meta-analysis.

Methods

Two independent reviewers searched the PubMed, Physiotherapy Evidence Database, Scopus, Cochrane Library, and Web of Science databases in Decembre 2023. Two independent assessor extracted data from randomized controlled trials (RCT). The included studies were RCT that compared the effects of the Schroth method in isolation to conservative interventions or no intervention. The methodological quality of the studies was assessed with the PEDro scale, and the risk of bias with the Cochrane Collaboration tool. Meta-analyses were conducted using fixed or random effects models according to the heterogeneity assessed with I^2 coefficient. Data on outcomes of interest were extracted by a researcher using RevMan 5.4 software.

Results

A total of 441 studies were screened. Six were included in the meta-analysis involving 144 patients with AIS. The methodological quality of the included studies ranged from high to low. Schroth method in isolation showed significant improvements in Cobb angle (mean difference (MD) = -3.18º; 95% CI: -4.30, -2.07; I^2: 0%), quality of life (MD = 0.28; 95% CI: 0.18, 0.38; I^2: 0%) and trunk rotation angle (MD = -2.12º; 95% CI: -3.44, -0.80; I^2: 71%) in the short-term.

Conclusion and significance

The Schroth method in isolation is effective for reducing the Cobb angle and the trunk rotation angle and for improving the QoL in the short-term compared to no intervention or other conservative therapies in AIS, but the improvement in Cobb angle did not exceed the minimum clinically important difference.

O30

EFFECTIVENESS OF RIGO CONCEPT PSSE IN ADULT SCOLIOSIS

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Introduction

Idiopathic Scoliosis is a common condition that affects individuals of all ages. Physiotherapeutic Scoliosis Specific Exercise (PSSE) studies show positive effects on Cobb angle, curve progression, pain, self-image, and mental health in the lives of adolescents with idiopathic scoliosis. Despite the prevalence of scoliosis found in the adult population the study of the effects of PSSE on adult scoliosis is limited. Adults with scoliosis report health-related quality of life dissatisfaction, functional limitations, pain, analgesic use, psychological distress, and lack of medical doctor direction on conservative management options. The effects of PSSE on the adult population has little evidence and remains relatively unknown.

Objective (s)

The aim of this study was to report outcomes from the adult scoliosis population who used Rigo Concept PSSE treatment and self-practice.

Study Design

Prospective case series: All new patients in 2022-2023 who did not have history of surgery and who agreed to participate in a 12-month study were treated using Rigo Concept PSSE at an outpatient orthopedic physical therapy clinic specialized in scoliosis treatment located in Lexington, MA.

Methods

The adults were evaluated at the start of treatment with Scoliosis Research Society 22-item outcome measure (SRS-22) and then reassessed via SRS-22, Global Rate of Change (GROC), and a 10-question survey at 3, 6, 9, and 12 months. After evaluation, nineteen adults with scoliosis ($\bar{x}$ = 58 years) were treated in an outpatient physical therapy clinic specializing in the care of those with scoliosis using Rigo Concept PSSE. During treatment a home program was established for the adults' self-practice between visits and after discharge. Each patient was seen weekly for two months and then as needed over 6-12 months.

Results

Number of sessions, 89.5% were treated for 15 or fewer sessions. Duration of sessions, 68.42% were seen for 2 hours per session. On average, the patients demonstrated improvement in each domain of the SRS-22 over the course of 12 months with clinically meaningful changes in pain, function, satisfaction with care, and total scores at each reassessment. The mode of response for the GROC was "a little better" to "somewhat better" at each timepoint.

Conclusion and significance

The current study describes the quality-of-life outcomes from the use of Rigo Concept PSSE, in the adult scoliosis population. The results indicate that this approach has an impact on improving quality of life, reducing pain, and improving function in adult scoliosis after 12 months of intervention.

O31

EFFECTS OF SCOLIOSIS-SPECIFIC EXERCISE IN ELECTROMYOGRAPHIC ACTIVITY OF PARAVERTEBRAL MUSCLES OF PARTICIPANTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS: AN ASSESSOR-BLINDED RANDOMIZED CONTROL TRIAL

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Introduction

Asymmetrical electromyographic (EMG) activity of paravertebral muscles predicts early curve progression of untreated adolescent idiopathic scoliosis (AIS). Real-time EMG signal altered while patients performing scoliosis-specific exercises (SSE). Thus, understanding the change of EMG activity of paravertebral muscles with AIS after prolonged SSE may assist in understanding the rational of SSE in preventing curve progression.

Objective (s)

To investigate effects of 6-months SSE in changing EMG activity of paravertebral muscles in participants with AIS.

Study Design

an assessor-blinded randomized control trial

Methods

Ninety-six volunteers with AIS participated in this study. Blocked randomization was performed, and EMG investigators were blinded to group allocation. Participants undertook EMG measurement at their first presentation, 3-months, 6-months and 12-months before doing SSE. The root mean square of the EMG (rms-EMG) signal was recorded with participants in sitting and doing voluntary back-extension. The rms-EMG ratio (rms-EMG ratio=rms-EMG at convexity/rms-EMG at cocavity) at upper end vertebrae (UEV), apical vertebrae (AV), and lower end vertebrae (LEV) of the major curve was calculated and analyzed with radiographic parameters at each corresponding timepoint. The SSE program comprised once per week of supervised SSE with home exercises for 3 months; following by once per month of supervised SSE with home exercises for 9 months, whilst the control group received the standardized physiotherapy care (postural education with 15min core exercise) every 3-months. Intension to treat and per-protocol analysis were performed.

Results

A significant group effect was found for the rms-EMG ratio at AV (sitting: F=5.12, $p<0.01$, back-extension: F=5.7, $p=0.03$). Post hoc comparison revealed a distinct lower rms-EMG ratio at 3-months

(sitting: 1.0±0.6 vs 1.2±0.1; p<0.01, back extension: 1.1±0.2 vs 1.3±0.1; p<0.01), 6-months (sitting: 1.1±0.4 vs 1.2±0.8; p=0.03, back extension: 1.1±0.8 vs 1.3±0.2; p=0.03) and 12-months (sitting: 1.1±0.2 vs 1.2±0.7; p<0.01, back extension: 1.1±0.8 vs 1.3±0.3; p=0.03) in the SSE group. The improvement of EMG discrepancy was observed with reductions of Cobb angle (r=0.82; p<0.01), side deviation (r=0.74; p<0.01) and asymmetrical truncal rotation (r=0.61; p=0.03) in the SSE group.

Conclusion and significance

In addition to reduction of Cobb angle, improvement of EMG discrepancy was observed in participants with AIS after structured SSE program.

O32

S4D SPECIFIC EXERCISES COMBINED WITH THE S4D BRACE IN DIFFERENT RISSER BONE MATURITY STAGES FOR THE TREATMENT OF ADOLESCENT IDIOPATHIC SCOLIOSIS: A RETROSPECTIVE COHORT STUDY

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Introduction

Adolescent idiopathic scoliosis (AIS) is a prevalent spinal disorder in adolescents, which can result in changes in postural and gait patterns. The severity of the disease due to the progression of the scoliotic curvature is associated with some risk factors corresponding to growth maturity, especially in girls aged between 10 and 12 years, in the period of menarche, with a Cobb angle > 25 degrees, a Risser sign between 0-1, and the peak bone growth spurt. However, there is a lack of studies on the effectivity of specific exercises on different bone maturity stages.

Objective (s)

To verify the effect of S4D Specific Exercises program with the S4D brace on scoliotic curvature in different Risser bone maturity stages

Study Design

Cross-sectional study

Methods

two hundred and thirty nine adolescents with AIS (Cobb angle 25 to 44 degrees) were evaluated, divided into two groups of bone maturity according to the Risser sign: Risser 0-2 group (n=124) and Risser 3-4 group (n=115). The evaluated sagittal parameters of the spine were: Cobb angle using radiograph exams and the angle of the thoracic kyphosis and the angle of the lumbar lordosis, both measured by an X-ray image examination. Intervention: S4D Specific Exercises program associated with the use of the S4D

brace, for six months, once a week, with a 30 minutes specific exercise program and 20-23 hours of use of the brace daily.

Results

A total of 239 AIS individuals were evaluated and divided in groups by Risser: 0-2 Risser group (124) and 3-4 Risser group (115). Significant differences were found for the cobb angle of the largest curve and the thoracic and lumbar curves individually in both groups after treatment, regardless of risser stage. And the results showed no difference between the groups.

Conclusion and significance

Conservative treatment with S4D Specific Exercises program with the S4D brace proved to be effective regardless of the skeletal maturity stage.

O33

IMPLICATIONS OF PEDIATRIC CHEST WALL SURGERIES ON THE RISK OF DEVELOPMENT OF SCOLIOSIS

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Introduction

Scoliosis, a three-dimensional deformity of the spine, with idiopathic scoliosis being the most diagnosed form. Complications arising from thoracic chest wall surgeries, including thoracotomy and sternotomy, often include scoliosis among other complications. However, reported prevalence rates of scoliosis following chest wall surgery vary widely.

Objective (s)

This study aims to compare the prevalence of scoliosis in children who have undergone chest wall surgery to the prevalence of idiopathic scoliosis in the general population, as well as to observe gender ratios and curve direction in post-surgery scoliosis cases.

Study Design

A systematic review

Methods

A search was conducted using PubMed, Scopus, and Embase databases to identify relevant studies. Inclusion criteria comprised studies reporting scoliosis prevalence post chest wall surgery with follow-up times post-surgery.

Results

The search yielded 30 articles, all retrospective institutional cohort studies published between 1975 and 2024.

Conclusion and significance

Despite heterogeneity in study characteristics, the analysis revealed a 15% prevalence of acquired scoliosis among 9982 children who underwent chest wall surgery, higher than the reported 1-3% prevalence in the idiopathic population. Only three studies showed prevalence rates similar to the idiopathic population, possibly due to short follow-up periods. Of the studies that reported curve direction, 47% report left thoracic curves. Also differing from the idiopathic population, there appears to be a 1:1 female to male ratio of acquired scoliosis post chest wall surgery. Considering curves can occur post chest wall surgery in the growing child at a rate higher than the general idiopathic

population, increased screening for scoliosis should be warranted for this population in an attempt to manage with an orthosis during skeletal immaturity. Further research with longer follow-up into skeletal maturity is warranted to better understand the implications of pediatric chest wall surgery on scoliosis development.

O34

RETROSPECTIVE ANALYSIS OF THE CO-OCCURRENCE OF SCOLIOSIS AND INFANTILE CHEST WALL SURGERIES

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Introduction

For the population that has experienced chest wall surgery in infancy the risk of developing scoliosis is poorly understood. White, Ginzburg & Taylor 2023, performed a meta-analysis of this relationship and revealed an over representation of scoliosis in the post-surgical population as compared to the prevalence of idiopathic scoliosis in the general public. That investigation was limited by the heterogeneity of the studies scrutinized, varying pre-surgical diagnoses, and difference in the techniques used to detect scoliosis. Only 12 studies were included in the meta-analysis, further demonstrating the gaps of knowledge in the current literature.

Objective (s)

While limited by the statistical power of the investigation, the meta-analysis suggested a possibility of clinical distinctions between idiopathic and post-surgical curve presentation and risks. This study aims to further evaluate the risk of developing scoliosis in the post-chest wall surgery population and to draw the distinction between the clinical presentation of the relative groups of patient populations. To this end, a retrospective analysis of electronic medical record data was carried out for the population seen at our regional medical center between 1999-2023.

Study Design

Retrospective analysis

Methods

SlicerDicer tool of Citrix Epic Electronic Medical Record (EMR) was used to detect the co-occurrence of all subtypes of scoliosis in the population described by the following diagnoses: Repair, Coarctation, Aorta; Repair, Tetralogy of Fallot; Correction, Transposition of Great Arteries; Repair, Truncus Arteriosus; Repair of Pulmonary Arterial Atresia; Repair of Esophageal Atresia; Repair, Total Anomalous Pulmonary Venous Return; Repair of Heart Defect; Repair, Tracheoesophageal Fistula. January 1st, 1999, to October 18th, 2023, were defined as time endpoints.

Results

The post-surgical population consisted of 318 patients, 27 of whom were later diagnosed with scoliosis. This represents 8.5% prevalence of scoliosis in the post-surgical group. Of the scoliosis positive group,

two cases were diagnosed as neuromuscular and 0 as degenerative, so the prevalence of idiopathic scoliosis in the post-surgical population was revealed to be 7.8%.

Conclusion and significance

The reported estimate of the prevalence of idiopathic scoliosis in the general population is 2-3% (Yilmaz et. al., 2020). It is also important to recognize that the data has been collected from a regional hospital that was the County hospital for the majority of the timespan studied, and individuals that were, in some cases, urgently operated on, were lost to follow up as the pt returned to their community for more routine care. This can be seen by the overall 0.08% prevalence of scoliosis cases seen at this hospital system. Further, the gender ratio of the scoliosis cases in the post-surgical population was revealed to be 1:1, while idiopathic scoliosis is reported varies from 4:1 to 10:1 female: male ratio.

O35

CONVEXITY ORIENTATION OF SINGLE SCOLIOSIS CURVES. ARE THEY AS WE HAVE ALWAYS BEEN TAUGHT? VERIFICATION OF 4470 CURVES

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Introduction

The aim of this study is to clarify in more detail a concept acquired too briefly and which can better suggest what really happens when a scoliotic curve occurs.
Considering the knowledge that has been painstakingly gathered about scoliosis, one of the data that is considered acquired is the typical convexity orientation of the curves in the frontal plane.
Classically, it is defined that about 80% of dorsal curves have right convexity, while for thoracolumbar or lumbar curves, the convexity of the curves is to the left in about 80% of cases.

Objective (s)

The purpose of this study is to verify this finding.

Study Design

Descriptive study

Methods

Data were collected from 4470 single curves of patients referred to a health institute, specializing in the conservative treatment of scoliosis.
Patients with scoliosis who had more than one curve were discarded to reduce the variables.
The curves collected had apexes only from D4 to L3. Curves with apexes higher or lower than the defined limits were discarded so as not to confuse the data with curves whose end vertebrae did not have similar inclinations.
Inclusion criteria
- Scoliosis curves with at least 10 Cobb degrees
Male and female patients
- Age 9-18
- Without previous treatments (braces or specific exercises).

Results

The evaluation of the x-rays collected highlighted the data, which are simplified in the following table

Apex	Rate of curves with right convexity	Prevalence of the apex vertebrae (right or left)
D5	41%	0,7%
D6	75%	1,7%
D7	81%	4,4%
D8	84%	7,8%
D9	85%	8.8%
D10	71%	8,2%
D11	52%	8,4%
D12	35%	23%
L1	34,%	18,6%
L2	34,%	14,7%
L3	32%	3%
L4	0,06%	0,4%

The trend is the one classically described **BUT** in the thoracic segment, the percentage of curves with right convexity exceeds 80% of cases only when the apex of the curve is between D7 and D9 and is progressively reduced as one moves away cranially or caudally.

The table shows that, for single curves, in the lumbar and thoracic segments of the spine there is no stark between right or left convexity.

The set of dorsal curves has a greater prevalence of convexity to the right, but this decreases gradually and regularly as one moves away from its peak (D8-D9).

In the lumbar region, the prevailing trend is the opposite but not clear-cut. The left convex curves are approximately 65%.

Conclusion and significance

These data suggest that there is a mechanical phenomenon that orients the convexity of the curve depending on the level of the apical vertebra. The mechanical phenomenon is still obscure, but it is a first piece of reasoning.

O36

DEVELOPING AND VALIDATING A MULTIVARIABLE PROGNOSTIC MODEL FOR RISK OF CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS: A PROSPECTIVE COHORT ANALYSIS

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Introduction

Currently, clinicians have difficulty in prognosing which patients with adolescent idiopathic scoliosis (AIS) are at risk for curve progression. Adding self-reported outcomes as potentially important prognostic factors may help to improve risk selection.

Objective (s)

To develop and internally validate a prognostic survival model exploring baseline variables for AIS curve progression.

Study Design

A longitudinal prognostic cohort analysis was performed on trial data (n=135 patients) including girls and boys diagnosed with AIS, Cobb angle of 25-40°, aged 9-17 years, remaining growth of at least 1 year, and previously untreated.

Methods

Prognostic outcome was defined as progress if curve progression of Cobb angle >6° occurred prior to skeletal maturity. Thirty-four candidate prognostic variables were tested. Time-to-event was measured with 6-months intervals over 3 years. Cox Proportional Hazards survival models (Cox) were used for

model development and validation and compared with machine learning models. The models were adjusted for treatment exposure.

Results

The final prognostic model included 127 patients predicting curve progression with acceptable discriminative ability (Concordance 0.791, 95%CI 0.72-0.86). Significant prognostic factors were Risser stage of 0 (HR=4.6, 95%CI 2.1-10.1, p<0.001), larger Cobb angle (HR=1.5, 95%CI 1.1-2.0, p=0.005), and higher score on patient-reported pictorial Spinal Appearance Questionnaire (pSAQ) (HR=1.4, 95%CI 1.0-1.9, p=0.040), while premenarchal status contributed to the model but was not a statistically significant individual predictor (HR=2.1, 95%CI 0.9-4.6, p=0.077). Not receiving night-brace treatment was a risk factor (HR 3.1, 95%CI 1.5-6.0, p=0.001) and adjusted for in the model. Sensitivity analysis displayed that Cox maintained acceptable discriminative ability (AUC=0.794, 95% CI=0.65-0.93) in comparison to machine learning algorithms.

Conclusion and significance

The prognostic model predicted curve progression of more than 6° with good accuracy. Adding patient-report of the pSAQ may be of clinical importance for the prognosis of curve progression in AIS.

O37

LOW BONE MINERAL DENSITY IS A POSSIBLE INDICATOR TO THE SEVERITY OF ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

The aetiology of adolescent idiopathic scoliosis (AIS) still remains unknown. Low bone mineral density (BMD) was supposed to be highly associated with the occurrence of AIS.

Objective (s)

The aim of the present study was 1)to verify whether lower bone density was associated with AIS and explore whether lower BMD is an primary etiology of the AIS, 2)evaluate whether the spinal curve severity and pattern contribute to the bone mineral density in AIS girls during the peripubertal period.

Study Design

A large cross-section study.

Methods

10-18 patients with adolescent idiopathic scoliosis routinely receive a DXA scan when first clinic visit. We divided all the AIS cases into 4 groups(none, mild, moderate and sever) according to the cobb angle. Age- adjusted BMD z -scores of AIS were determined from the mean BMD of the age-matched control girls. BMD z -score < -2 SD was classified as osteopenia, while BMD z -score >-2SD was classified as normal BMD status.

Results

A total of 952 adolescent girls fulfilling the inclusion criteria entered the study. The age range was 10–18years. The BMD range was 0.22-0.46. The rate of lower BMD Z score in Group 1-4 was 47.0%, 52.1%,55.5% and 59.7% respectively. Statistical significant was found among all the groups 1,2,4.

Conclusion and significance

Based on our BMD detect system, low BMD(<-2SD) cases demonstrate a high incidence of scoliosis, the severity of deformity might relate to the level of BMD. Compared with the lumbar curve scoliosis, the thoracic curve scoliosis had a relatively lower BMD.

O38

CORRELATION BETWEEN GENERAL JOINT MOBILITY (BEIGHTON SCORE) AND THE SPECIFIC CURVE MOBILITY (STIFFINESS SCOLOSIS TEST) IN PATIENTS WITH IDIOPATHIC SCOLIOSIS

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Introduction

Recent studies have explored the relationship between generalized hypermobility, assessed through the Beighton score, and scoliosis, generating interest in professionals dedicated to conservative treatment. Specifically, the Stiffness Scoliosis Test (SST) has been utilized to assess the mobility of scoliotic curves, particularly identifying rotational flexibility.

Objective (s)

This study aimed to assess the correlation between general joint mobility (Beighton score) and the specific curve mobility (SST) in patients with idiopathic scoliosis.

Study Design

Retrospective correlational study.

Methods

A retrospective study was conducted using a database from a private clinic in Brazil, involving 217 patients sampled from May 2021 to November 2023. Forty-four patients of both sexes, aged between 8 and 39 years, and with an angle of trunk rotation (ATR) > 5° were arbitrarily included. Each participant underwent evaluations using a scoliometer for ATR and SST measurements. For the SST, patients performed an inclination towards the convexity of the curve during forward bending of the trunk. In this position, the degree of the rib hump was measured and recorded again. The Rotational Flexibility Index (RFI) was calculated using the formula RFI = ((ATR − SST)/ATR) x 100, providing a percentage result of the SST. The nine-point Beighton score, and the SST were assessed by the same physiotherapist. The Beighton score comprised joint mobility tests related to spine, knees, elbows, thumb and little finger. Generalized joint hypermobility was determine for scores of four or higher. The Kendall's correlation was calculated between the SST (RFI) and Beighton score ($p < .05$). The sample size calculation resulted in a minimal sample of 29 subjects (two-tailed; H1= 0.5; α= 0.05; β= 0.20).

Results

The sample comprised 57 curves from 44 patients, including 30 females, with a mean age of 16.0±5.9 years, height 160.2±12.6 cm, and weight 50.6±14.1 kg. The mean ATR was 10.6°±3.8°, SST -2.9°±7.7°, RFI

132%±104%, Beighton score 4.3±2.3, and Cobb angle 33.7°±15.4°. The correlation between SST (RFI) and the Beighton score was positive, very low, and non-significant (n= 57; τ= 0.010; p=0.916).

Conclusion and significance

The findings of this study indicate that there is no correlation between the general joint mobility (Beighton score) and specific curve mobility measured through the SST (in addition to RFI) in patients with scoliosis. Based on our results, we suggest the use of both assessments for the evaluation and follow-up of patients with scoliosis. Further research is needed to explore specific curve mobility basend on SST and RIF as predictive factors for conservative treatment success.

O39

MAXIMAL AND ASYMMETRICAL SUBMAXIMAL PARASPINAL MUSCLE ACTIVATION IN ADOLESCENT IDIOPATHIC SCOLIOSIS DURING SIMPLE BACK EXTENSION TASKS.

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Introduction

Curve progression in adolescent idiopathic scoliosis (AIS) is associated with three-dimensional wedging of spinal vertebrae and discs. It is well known that muscle activity and morphology influence muscle force generation, and that the forces applied to bones and discs are substantial moderators of growth and adaptation. There is growing evidence for asymmetrical force-generating capacity in paraspinal muscles in AIS. However, data varies greatly between studies, and previous outcomes are highly dependent on the methodological approaches taken.

Objective (s)

The aim of this study was to determine if the symmetry of paraspinal muscle activation amplitude differs in adolescents with AIS compared to controls, during a voluntarily driven, symmetrical, submaximal task.

Study Design

Experimental, cohort study with matched control participants.

Methods

Females with AIS (primary right thoracic curves, n=24, mean[SD] age: 13.8[1.5] years) and without AIS (n=20, 13.8[1.8] years) were recruited through a Spine outpatient clinic at the Queensland Children's Hospital, local physiotherapy practices, and the local community.

Muscle activity was recorded using bipolar surface electrodes placed bilaterally at vertebral levels: T9 and T12. Six maximal trunk extensions (ie maximal voluntary contractions) were performed in lying: three in an *unresisted* pose, and three were manually *resisted* at the shoulders and thighs. The maximum activation recorded in any trial, for each recording location separately, was used for normalisation. Participants then performed a series of five submaximal trunk extensions while lying, each contraction was performed for between 20-30 seconds, at an intensity equal to between 10-20% of their maximal activation (i.e. 10-20% MVC, from T9 left + right). The symmetry index of muscle activity

was determined using Ln(right/left), which equates to Ln(convex/concave) in the AIS cohort. To assess the difference in muscle activation symmetry index between the groups, repetitions (1-5) and vertebral levels, a linear mixed model analysis was conducted. Participants were entered as random intercepts, with repetition, and interaction between group and vertebral level included as a fixed effects.

Results

Greater paraspinal muscle activation asymmetry (convex>concave) was observed at the apex of those with AIS versus T9 of the control group (Estimate 0.36, 95%CI 0.05 to 0.80, p=0.002). There was no difference in activation symmetry between groups at T12 (Estimate 0.27, 95%CI -0.04 to 0.58, p=0.12).

Conclusion and significance

Compared to control participants, adolescents with AIS display greater asymmetry in paraspinal muscle activation at T9 during submaximal trunk extensions. This asymmetry was not observed at T12. Asymmetric paraspinal muscle activation may contribute to asymmetrical muscular forces applied to the developing spines of children with AIS.

O40

SUSPECTED HIGH PREVALENCE AND GENDER DIFFERENCE OF SCOLIOSIS CURVES WITH THE APEX AT T12.

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Introduction

To gather information to better describe spine misalignments, an observational study was completed that aimed to calculate the apexes of scoliotic curves. A sample of 13382 curves had been collected. They were distributed into three groups: single curves, double curves, and triple curves.

To reduce the variables and collect clearer data, only the subgroup of single curves, which included 4469 curves, had been isolated.

Among the results of this study, one of the most striking data was the frequency of T12 as the apex of the curves.

The observations clearly showed that 23% of scoliotic curves have T12 as their apex.

Objective (s)

This analysis focused only on the T12 vertebra, which appears to be a crucial segment of the spine when idiopathic scoliosis curves appear.

Study Design

Observational

Methods

A total of 1040 single curves with apex in T12 from scoliosis patients (866 Females and 176 Males) were selected. Mean Cobb degrees and convexity of the curves were calculated. The curves were classified considering some basic features.

Results

The percentage of apex scoliotic curves in T12 is 23% of a group of 4469.
The overall convexity orientation of the curves is 37% to the right.
The mean Cobb degrees of male patients is 18° (median 17)
The mean Cobb degrees of female patients is 20.7° (median 18)
There are no significant differences between the mean Cobb degrees of the right and left convexity curves.

Conclusion and significance

There are no significant differences between male and female scoliosis curves with T12 as apex.

The T12 vertebra has an anatomical conformation different from all others. The shape and orientation of the posterior joints are a hybrid of the joints of the thoracic and lumbar vertebrae, making it an atypical vertebra.

The frequency of scoliotic curves with apex at D12 is the highest of all other vertebrae.

This data combined with the unusual and unique shape of this vertebra makes one suspect a mechanical but still unclear cause of the scoliosis curves that are observed more frequently.

O41

VALIDITY AND ACCURACY OF AUTOMATIC COBB ANGLE MEASUREMENT ON 3D SPINAL ULTRASONOGRAPHS FOR CHILDREN WITH ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

Ultrasonography is a non-ionizing radiation imaging method which can be used to monitor and diagnose children with adolescent idiopathic scoliosis (AIS). The Cobb angle measurements on ultrasonographs using the centre of lamina (COL) method have been reported to be accurate and reliable. However, the manual measurement is time-consuming and requires training to get accurate results. Clinicians has sought for artificial intelligence (AI) to automate the Cobb angle measurements to streamline the process.

Objective (s)

This study aimed to apply machine learning (ML) algorithm (AI method) to automate Cobb angle measurement on spinal ultrasonographs and to investigate the validity and accuracy of the method.

Study Design

Cross-sectional

Methods

Ethics approval was granted to extract 143 3D spinal ultrasonographs from the local scoliosis clinic. The inclusion criteria were children a) diagnosed with AIS, b) 10°≤Cobb angle<55°, and c) no prior surgery. Of the 143 spinal ultrasonographs, 70 were used for model training with data augmentation to increase the effective training dataset by randomly rotating, translating, zooming, flipping, and contrast adjusting the images. The remaining 73 were used for validation. A convolutional neural network, a type of ML model, was developed to identify the COLs of the spinal column in 3D coordinates on the ultrasonograph. Using the predicted COLs, an automatic algorithm was developed to measure the Cobb angle. Validating the developed method consisted of comparing automatic measurements with manual ones performed on the same ultrasonograph and calculating the inter-method intraclass correlation coefficient ($ICC_{3,1}$) and its 95% confidence interval, standard error of measurement (SEM), and percentage of errors within clinical acceptance (≤5°). All manual measurements were performed by a rater with 12+ years of ultrasound experience.

Results

Radiograph — Automatically measured ultrasonograph of the same subject

Among the 73 spinal ultrasonographs, 146 curves were measured manually. The ML method detected 123/146 (84%) curves. The average manual and automatic Cobb angles (123 curves) were 22.7±8.0° and 22.9±8.6°, respectively. Good reliability was achieved with an $ICC_{3,1}$ of 0.81 [0.74, 0.86], and a SEM of 1.4°. A total of 74% (91/123) of the measurements were within clinical acceptance. The average measurement time per ultrasonograph was 37±8 seconds. Additionally, the algorithm outputs images illustrating the paired predicted COLs for each vertebra in the coronal, sagittal, and transverse views, and which pairs were used for measurement (attached Figure).

Conclusion and significance

The automatic ML-method was able to detect 84% of the curves with a 1.4° SEM. More training dataset may require to improve the ML accuracy. Additionally, the ML-method illustrates the predicted COLs in all 3D views and how the Cobb angles were measured so that clinicians can confirm their validity. With an average measurement time of 37 seconds, these features of the algorithm make ultrasound a more accessible method of imaging children with AIS; thereby reducing their risk of developing cancer.

O42

VALIDITY OF A FAST AUTOMATED 3D SPINE RECONSTRUCTION MEASUREMENTS FOR BIPLANAR RADIOGRAPHS

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Introduction

Three-dimensional (3D) spine reconstruction with measurements from biplanar radiographs provides better visualization and assessment for children with adolescent idiopathic scoliosis. The trend in recent years has shifted towards employing automated reconstructions and measurements to reduce human variation and streamline clinics. A Convolution neural network (CNN) is the most common machine learning algorithm for medical imaging applications.

Objective (s)

This study aimed to validate the accuracy and reliability of a fast 3D spine reconstruction algorithm to export curvature parameters based on artificial intelligence (AI).

Study Design

A retrospective study.

Methods

An ethics approval was granted. Three hundred and eighty biplanar low-dose radiographs, non-surgical cases, from the EOS system were randomly exported from the local scoliosis clinic. Out of the 380 paired images, 304 (80%) and 76 (20%) paired images (80%) were employed for training and testing, respectively.

To reconstruct 3D spine, dual-stage CNN networks were developed to identify and extract the entire spinal column (T1-L5), and individual vertebra including the center of the vertebral body and centers of both pedicles. The reconstruction process was followed based on a 3D/2D registration process. The curvature parameters such as the Cobb angles (CA), apical axial vertebral rotation (AVR), kyphotic angle (T1–T12 KA), and lordotic angle (L1-L5 LA) were reported. An experienced rater with 8+ years of scoliosis measurement experience measured the curvature parameters manually. The agreement of number of curves between the automatic and manual measurements was calculated. The mean absolute difference and standard deviation (MAD±SD) between the automatic and manual measurements were reported. The percentages of automatic measurements falling within the clinically acceptable errors for CA (5°), AVR (5°), KA (9°), and LA (9°) were analyzed. The inter-method reliability using the intraclass correlation coefficient $ICC_{[2,1]}$ with 95% confidence interval was calculated for all parameters. A Bland-Altman plot between the automatic and manual measurements was used to evaluate the bias and agreement.

Results

The average time to display the 3D spine and report the measurements was 5.2±1.3s. Among 76 paired images, 134 and 128 curves were exported automatically and measured manually, and 100% of the AI measurements overlapped with the manual measurements. Among the 128 curves, the MAD±SD and % of the clinical acceptance for CA, AVR, KA, and LA were 3.3±3.5 (98.4%), 1.5±1.5 (99.2%), 3.3±2.6 (98.7%) and 3.5±2.5 (100.0%), respectively. All the $ICC_{[2,1]}$ for the compared parameters was>0.99. The bias of CA was 0.6°, and it was 100% agreement within the 95% confidence interval (Fig. 1).

Conclusion and significance

The developed algorithms were able to display the 3D image and export parameters fast within 6s. The AI method reported the spinal parameters accurately. The inter-method reliability for all parameters was >0.99. This AI method is ready to be used in our scoliosis clinic.

O43

SURFACE TOPOGRAPHY DEMONSTRATES GRADUAL IMPROVEMENT IN SPINAL RANGE OF MOTION IN ALL THREE PLANES FOLLOWING POSTERIOR SPINAL FUSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

After posterior spinal fusion (PSF) for adolescent idiopathic scoliosis (AIS), there is alteration in trunk range of motion (ROM) in the coronal, sagittal and axial planes. Surface topography (ST) has been shown to be a reliable tool to measure spinal ROM, while eliminating radiation exposure.

Objective (s)

This study sought to use ST to evaluate spinal ROM after PSF in AIS patients over time.

Study Design

Retrospective review of a prospective registry cohort.

Methods

Patients in a prospective spinal alignment registry were retrospectively reviewed. Inclusion criteria required an age of 11-20 at surgery, a diagnosis of AIS, as well as valid ROM measurements obtained via ST scanning. ST measuring axial, sagittal and coronal ROM was performed at five timepoints: pre-operative, 3 months, 6 months, 12 months, and 24 months post-operation. All patients participated in physical therapy starting at post-op day 1. All patients had a proximal fusion level of T2-T4; selective thoracic group (STF) included patients with a distal fusion level of T12/L1, and nonselective fusion (NSF) patients had a distal fusion level of L2/L3. Generalized estimating equations modeling across timepoints utilizing axial, sagittal, and coronal ROM as the dependent variable were conducted. Covariates included age, sex, and body mass index. P-values ≤ 0.05 were significant.

Results

The study included 52 patients with a mean age at surgery of 14.9 ± 2.2 years; 74.5% were female, and mean BMI was 21.7 ± 4.8 kg/m2. 38 patients were in the NSF group (average Cobb angle = 61.6°) and 14 patients were in the STF (average Cobb angle = 53.8°). In the NSF group, ROM in all three planes was significantly decreased by an average of 30% at 6 weeks post-op and improved at 2 years post-op to only

an average of 16% decrease ROM compared to pre-op. In the STF group, ROM was significantly decreased by 23% at 6 weeks post-op and trended towards an increased ROM of 11% at 2 years post-op compared to pre-op in the sagittal plane and significantly decreased by 26% at 6 weeks post-op and trended towards an increased ROM of 5% at 2 years post-op compared to pre-op in the axial plane. In the coronal plane, ROM significantly decreased by 23% at 6 weeks post-op and further decreased to 50% at 2 years post-op compared to pre-op.

Trunk Range of Motion Correction Over Time after Nonselective Thoracic Posterior Spinal Fusion

Trunk Range of Motion Correction Over Time after Selective Thoracic Posterior Spinal Fusion

	Axial	Sagittal	Coronal
Average Change in ROM (Degrees)			
Pre-op			
6 weeks	-28.25	-27.40	-35.05
3 months	-25.94	-27.55	-24.21
6 months	-25.54	-26.48	-36.41
1 year	-19.52	-10.85	-12.36
2 year	-14.78	-16.6	-14.39

	Axial	Sagittal	Coronal
Average Change in ROM (Degrees)			
Pre-op			
6 weeks	-29.02	-22.99	-22.75
3 months	-35.25	-23.90	-19.67
6 months	-17.07	-16.04	1.67
1 year	-15.18	-12.04	-12.46
2 year	4.99	10.94	-49.48

Conclusion and significance

The coronal, sagittal, and axial ROM as measured by surface topography demonstrates significant decrease from preoperatively to postoperatively following posterior spinal fusion; however, this deficit trends towards improvement over time. Our data further suggests that NSF patients improve their ROM in all three planes gradually over two years postoperatively. Improved long-term followup with larger cohorts will provide definitive data regarding postoperative spine ROM.

O44

CAN SURFACE TOPOGRAPHY RELIABLY DETERMINE THE RIGO CLASSIFICATION SYSTEM?

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Introduction

In patients with adolescent idiopathic scoliosis (AIS), the Rigo classification system (RCS) is used to classify the curve pattern to facilitate the conservative treatment plan. Few studies have investigated the inter- and intra-observer reliability of the RCS using radiography or clinical photography. None have done so using surface topography (ST), except for a case report. Understanding the reliability of the RCS using ST would allow optimization in 3D without radiation exposure.

Objective (s)

1) To investigate the reproducibility of ST-based and X-ray-based RCS for three evaluators for overall types and subtypes; 2) To determine accuracy and standard error measurement (SEMs) between ST-based and X-ray-based RCS for overall types and subtypes.

Study Design

Retrospective, blinded study in which three investigators applied the RCS.

Methods

One investigator selected both X-ray and ST images of AIS patients between the ages of 10 and 18, with images being non-in-brace. Then, an additional three investigators used the RCS to assess images from the ST system (Diers Formetric 4D, Germany) and EOS radiography system (EOS Imaging, Paris, France) at Scoliosis Clinic or Musculoskeletal Functional Assessment Center. Each of those 3 investigators was blinded to review all X-ray and ST images, twice for each patient on different weeks, with 372 overall image readings. Afterwards, all investigators agreed upon the correct RCS scores for the finalized classifications. The statistical methods included intra- and inter-observer intraclass correlation coefficients (ICCs) and the accuracy of ST-based and X-ray-based RCS. P<0.05 was considered significant.

Results

31 children (23 females, 8 males) with AIS were selected, with average age of 13.5 years old. For RCS types, the average intra-observer ICC value was slightly better for ST (0.77, p<0.001) than X-ray (0.75, p<0.001). For RCS subtypes, the average intra-observer ICC value was again slightly better for ST (0.74, p<0.001) than X-ray (0.65, p<0.001). The inter-observer reliability was expectedly lower than intra-observer, with ST (0.53, p<0.001) comparable to X-ray (0.54, p<0.001) for the type. For the subtype

inter-observer reliability, ST (0.43, p<0.001) was slightly better than X-ray (0.36, p<0.001). For the type, the overall accuracy of the observers compared to the finalized classifications was slightly lower for ST (77.96%, SE 3.04%) than X-ray (79.57%, SE 2.96%). For the subtype, the accuracy of observers was slightly higher for ST (70.97%, SE 3.33%) than X-ray (65.05%, SE 3.50%). The highest intra-observer ICC was ST-based E type (0.65) as compared to X-ray-based B type (0.58). However, both ST and X-ray had the lowest ICC's of less than 0.28 for the C type.

Conclusion and significance

ST-based RCS demonstrates high intra-rater reproducibility and moderate inter-rater reproducibility. ST-based RCS is comparable to X-ray-based RCS, and therefore can be considered a reliable alternative in clinical application. However, it is noteworthy that there is a weaker reproducibility for the C type.

O45

THE TEST-RETEST RELIABILITY OF FRONTAL, SAGITTAL, AND TRANSVERSE SPINAL MEASUREMENTS OF ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS OBTAINED USING 3D ULTRASOUND IMAGING

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Introduction

Clinicians monitor scoliosis progression using radiographs during growth. We compared standing imaging positions because the arms must be elevated to visualize all vertebrae, possibly affecting sagittal spinal parameters. 3D Ultrasound (3DUS) is a safe method to assess arm positions without any radiation exposure, but its test-retest reliability has not been established for common standing radiograph positions.

Objective (s)

The aim was to determine the test-retest reliability of frontal, sagittal, and transverse measurements obtained from three positions using 3DUS imaging in Adolescents with Idiopathic Scoliosis (AIS).

Study Design

Within-session test-retest study comparing the reliability of measurements obtained from 3DUS images in three standing positions.

Methods

Females (n=32) and males (n=10) with AIS were recruited from a scoliosis clinic and from consultation in the community in Edmonton, Alberta. Participants underwent US scans in three positions: habitual standing, fingers to clavicles, and hands resting on anterior wall. Participants were re-scanned in the same three positions 20-minutes following the first scans. Custom software was utilized to obtain curve angle, whole thoracic kyphosis, T4/T5-T11/T12 kyphosis, lordosis, and AVR twist measurements. Test-retest reliability ($ICC_{3,1}$) with standard error of measurement (SEM) was assessed by one evaluator who was blinded to the test measurement and measurements from other positions when completing retest measurements.

Results

Forty-two participants with AIS had an age, height, and weight of 15±2 years, 164±10cm, and 54±11 kg, respectively. Mean curve angle in standing was 23±11°. The numbers of measurements satisfying the criteria for research/individual use ($ICC_{3,1}$>0.70/0.90) were: Curve angle(3/2), kyphosis(3/1), T4T5 Kyphosis (3/2), lordosis(3/1), and AVR twist(3/3) (Table 1). All measurements for hands on wall met the

Abstracts

reliability criteria for individual use ($ICC_{3,1}>0.90$). The ranges of SEM for curve angle, kyphosis, lordosis, and AVR twist were adequately small at 3.0-4.8°, 4.1-6.2°, 3.9-5.7°, and 8.7-8.7°, respectively.

Table 1.	Maximum Curve Angle		Maximum Whole Thoracic Kyphosis		T4/T5-T11/T12 Kyphosis		Lordosis		AVR Twist	
	$ICC_{3,1}$ (95%CI)	SEM (degree)	$ICC_{3,1}$ (95%CI)	SEM (degree)	$ICC_{3,1}$ (95%CI)	SEM (degree)	$ICC_{3,1}$ (95%CI)	SEM (degree)	$ICC_{3,1}$ (95%CI)	SEM (degree)
Habitual Standing	0.92 (.87-.96)	3.0	0.88 (.79-.93)	4.2	0.90 (.83-.95)	3.7	0.88 (.78-.93)	5.1	0.96 (.92-.98)	1.6
Fingers to Clavicle	0.82 (.70-.90)	4.8	0.88 (.78-.93)	5.1	0.83 (.70-.90)	5.3	0.87 (.77-.93)	5.6	0.91 (.84-.95)	2.2
Hands on Wall	0.92 (.84-.96)	3.5	0.91 (.84-.96)	4.0	0.92 (.85-.96)	3.6	0.93 (.87-.97)	3.9	0.94 (.88-.97)	2.0

Conclusion and significance

3DUS produces frontal, sagittal, and transverse spinal measurements with adequate test-retest reliability for research use in three standing positions. Additionally, the hands on wall position produces sufficiently reliable measurements for clinical practice.

O46

QUANTIFYING FULL SPINE PARASPINAL MUSCLE VOLUME, INTRAMUSCULAR FAT AND FAT-FREE MUSCLE ASYMMETRY IN ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

Adolescent idiopathic scoliosis(AIS) is characterized by an atypical 3D spinal curvature that develops/progresses between ages 10-18 years. Asymmetry in paraspinal muscle size and quality influences force-generation capacity and may contribute to asymmetrical vertebral growth.

Objective (s)

We aimed to quantify full spine paraspinal muscle volume and intramuscular fat asymmetry in female adolescents with AIS and age-matched controls.

Study Design

Data originates from the case-control Back-in-Action study.

Methods

T1-weighted and mDixon MRI scans were performed on 23 female adolescents with primary-right-convex thoracic scoliosis [Cobb angle:38±16°; age:13.7±1.5 years]; and 20 controls [age:13.6±1.9 years]. Muscle volumes (multifidus and longissimus) were determined at vertebral levels T6 to L4. Fat-fraction maps from mDixon scans were co-registered with muscle volumes to determine intramuscular fat proportions. Muscle, intramuscular fat, and fat-free volume asymmetry indices [ln(concave/convex)] were determined.

Results

This work identified significant asymmetries in the AIS participants' paraspinal muscle volume, intramuscular fat and fat-free muscle along the full length of the scoliotic curve, which were greater than observed in control participants with symmetrical spines (p<0.05). Mean(SD) shown in figures.
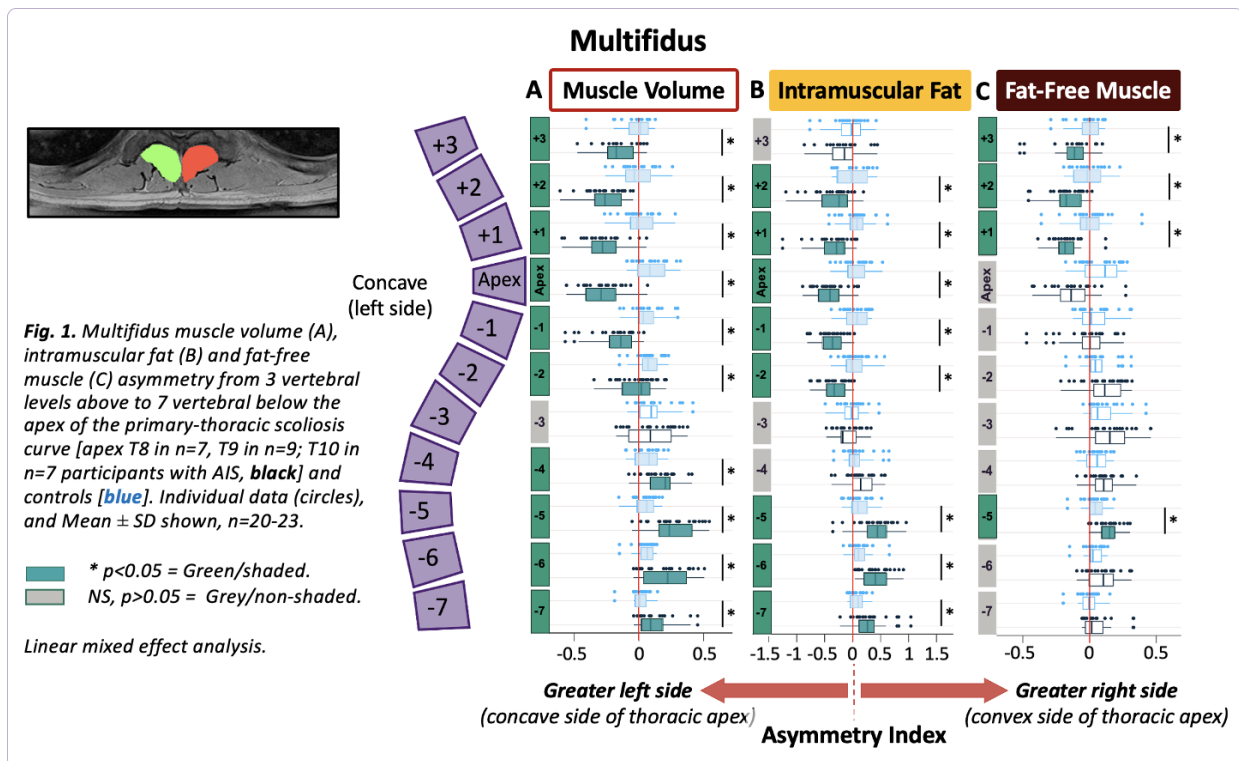
Overall volume: Multifidus's volume was significantly greater on the concave-side of the spine near the thoracic scoliotic curve apex and greater on the convex-side in the lumbar spine for the AIS group
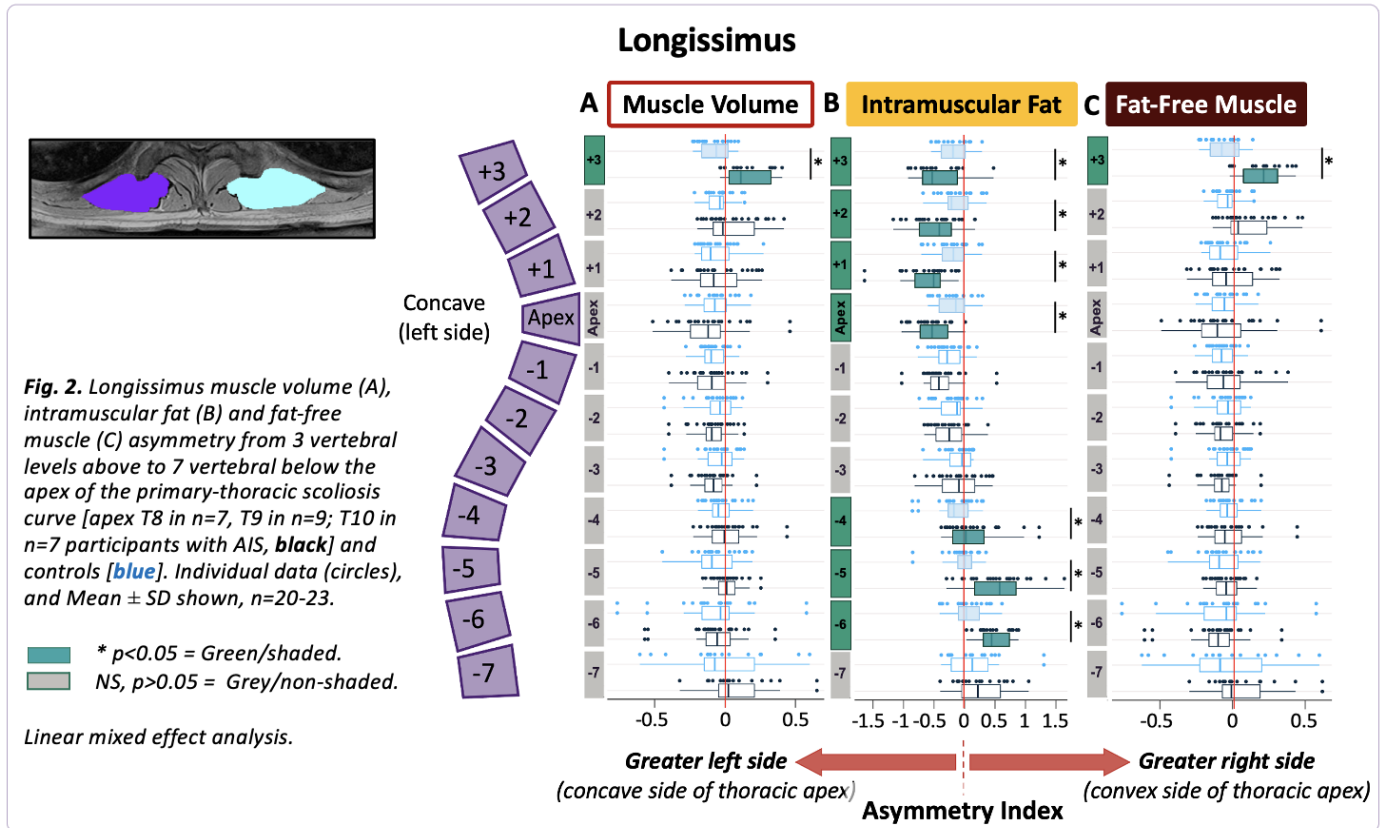
(p<0.05, Fig.1A). For longissimus, only the volume at the 3rd vertebral level above the apex was greater on the concave side (p<0.05, Fig.2A).

Intramuscular fat: Both multifidus and longissimus intramuscular fat were significantly greater on the concave-side of the spine near the thoracic scoliotic curve apex (p<0.05, Fig.1B and 2B) and in the lumbar spine, greater on the convex-side for the AIS participants (p<0.05, Fig.1B and 2B).

Fat-free volume: Multifidus's fat-free muscle volume three vertebral levels above the apex was significantly greater on the concave-side and greater on the convex-side at the 5th vertebral level below the apex (p<0.05, Fig.1C). For longissimus, only at the 3rd vertebral level above the apex was the fat-free muscle volume greater on the convex-side (p<0.05, Fig.2C).

Fig. 1. Multifidus muscle volume (A), intramuscular fat (B) and fat-free muscle (C) asymmetry from 3 vertebral levels above to 7 vertebral below the apex of the primary-thoracic scoliosis curve [apex T8 in n=7, T9 in n=9; T10 in n=7 participants with AIS, **black**] and controls [blue]. Individual data (circles), and Mean ± SD shown, n=20-23.

* p<0.05 = Green/shaded.
NS, p>0.05 = Grey/non-shaded.

Linear mixed effect analysis.

Fig. 2. Longissimus muscle volume (A), intramuscular fat (B) and fat-free muscle (C) asymmetry from 3 vertebral levels above to 7 vertebral below the apex of the primary-thoracic scoliosis curve [apex T8 in n=7, T9 in n=9; T10 in n=7 participants with AIS, **black**] and controls [blue]. Individual data (circles), and Mean ± SD shown, n=20-23.

* p<0.05 = Green/shaded.
NS, p>0.05 = Grey/non-shaded.

Linear mixed effect analysis.

Conclusion and significance

Compared to the control group, participants with AIS have significant asymmetry in multifidus volume, intramuscular fat, and fat-free muscle across multiple vertebral levels around the thoracic curve apex and in the lumbar spine. Longissimus also has significant asymmetry in intramuscular fat levels around the apex of the thoracic curve and the lumbar spine. This provides evidence of an imbalance in the force-producing capacity of paraspinal muscles in AIS, particularly in the deep paraspinal muscle, which applies forces to the transverse and spinous processes of the vertebrae. The next step in this data collection is to determine if these asymmetries are correlated with curve severity, future progression of the curve, and bony asymmetries identified in our participants with AIS.

O47

ASYMMETRY IN THE ONSET OF PARASPINAL MUSCLES ACTIVITY DURING RAPID ARM MOVEMENTS DIFFERS IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS COMPARED TO THOSE WITH A SYMMETRICAL SPINE

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Introduction

There is growing evidence of altered muscle activation in adolescent idiopathic scoliosis (AIS) however many previous studies are limited by insufficient clarity on tasks performed, and data recording and processing techniques. Muscle activation is one of the factors that contribute to muscle force generation. If an asymmetry in paraspinal muscle activation is present in AIS, it may contribute to an asymmetry in forces applied to the spine, and curve progression.

Objective (s)

To determine if symmetry of paraspinal muscle activation onset timing differs in those with AIS compared to controls during a simple, highly repeatable movement task.

Study Design

Experimental, cohort study with matched control participants.

Methods

Girls with AIS [n=24; primary right thoracic curve; Cobb angle 39.5(16.4)°, age 13.8(1.5) years], and age matched controls [n=20, age 13.1(1.8) years] participated. Surface electrodes were placed bilaterally on anterior deltoid, and erector spinae adjacent to C7, T9, T12 and L5 vertebrae. In response to a visual (light) signal, participants performed a bilateral rapid arm flexion while holding a small wooden rod (in both hands to aid movement symmetry). Muscle activation onsets were manually selected while blinded for group, from 6 trials for each participant. Activation symmetry (i.e. onset left – right) was calculated for each muscle pair. To compare between groups, a linear mixed model with group and muscle as fixed factors and participants as random intercepts was used.

Results

Right anterior deltoid onset was earlier than the left in 65% of trials, however there was no difference in this asymmetry between groups (χ^2 p=0.22). There was a significant Group×Muscle interaction (p<0.01)

for activation asymmetry, with the difference between groups identified at T9 (mean difference 15ms; 95%CI: 5-26ms, post hoc p<0.01). Activation was 7.4ms (95%CI: 3.3-11.0ms) earlier on the right (convex) side of the curve in AIS. In contrast activation was 8.2ms (95%CI: 3.3-13.0ms) earlier on the left side in controls. There were no group differences at other vertebral levels (all post hoc p>0.64).

Conclusion and significance

The result of this study provides evidence of a difference in paraspinal muscle activation onset at the level of the curve apex in AIS during a well-controlled symmetrical upper limb movement task. It is likely that the longissimus muscle contributes the greatest to the recorded muscle activation at T9. The longissimus is a powerful extensor and lateral flexor that attaches to the transverse processes and the lower rib angles. These bony structures are known to present with deformation in AIS. Future studies are now justified to investigate the underlying mechanisms for this difference in activation, and its potential consequences on spine form in AIS.

O48

EFFECTIVENESS OF BRACE TREATMENT IN ADOLESCENTS IDIOPATHIC SCOLIOSIS (AIS) PATIENTS WITH CURVES BETWEEN 40° AND 60° COBB

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Introduction

Rejecting to receive surgery is very common among adolescents idiopathic scoliosis (AIS) patients with advanced curves (> 45°). How to stop disease progress among AIS patients who rejected survey ever is a global challenge. Brace treatment has the potential to improve the disease progress, but strong scientific evidence on bracing efficacy for patients with curves greater than 40° remained absent.

Objective (s)

In this study, we aimed to investigate the clinical effectiveness of bracing treatment for AIS patients with curves between 40°-60° Cobb, and explore indicative factors associated with treatment success.

Study Design

A retrospective study.

Methods

This is a retrospective cohort study in which consecutive scoliotic patients visiting a scoliosis center between Jan 1, 2015 and Jun 31, 2020. The inclusion criteria are: age between 10-18 years; initial main curve magnitude between 40°-60° Cobb; Risser grade 0-4; received bracing treatment for AIS, and have been followed-up for at least 6 months since brace treatment started. Primary outcomes was the change of patients' radiographic and clinical outcome since the treatment, and was categorized into three groups: improved (6° or more), unchanged (+/−5°) and progressed (6° or more). Cox proportional-hazards model was used to investigate the associations between the probability of treatment success and clinical predictor variables.

Results

Overall, a total of 189 patients with a mean age of 13.1 ± 1.7 years were enrolled in this study, in which 159 (84.1%) were girls. The mean initial curve magnitude was 46.7° ± 5.6° Cobb. And the average Cobb angle after follow-up was 39.9° (SD 11.4, 14.6% reduction). Of the 189 patients with definite treatment outcomes, 134 (70.9%) obtained curvature correction at the end of follow-up, while 28 (14.8%) cases remained stable, and 27 (14.3%) patients had curve progression. Kaplan-Meier survival analysis showed that on average, 50% of the AIS patients could achieve curve reduction of at least 6° in 1.67 years after

treatment imitation. Initial in-brace correction (IBC) rate was associated with curve improvement rate. Compared with patients who had IBC rates lower than 30%, those who had an IBC rate between 30% - 50% were 3.67 (95% CI 1.78-7.54) times more likely to achieve treatment success, and the number for those with IBC rates of 50% or more was 3.09 (95% CI 1.54-6.20).

Conclusion and significance

Brace treatment is effective in treating AIS patients with curves between 40° to 60°, and it could be considered as a treatment option for patients within this curve range, especially among those who rejected surgery. Clinicians are advised to using initial IBC rate as a consideration of brace treatment. Given the observational nature of this study, future randomized controlled trials is needed to confirm the findings of this study.

O49

COMBINED EFFECT OF COMT AND MTHFR GENETIC VARIANTS ON ADOLESCENT IDIOPATHIC SCOLIOSIS PROGRESSION

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Introduction

There is a growing interest in identifying genetic variants associated with pathogenesis and progression of idiopathic scoliosis. Genetic variants encoding both low COMT and MTHFR activity have been reported to be associated with idiopathic scoliosis. Additionally, treatment with folinic acid was reported to have improved scoliosis in an infant with severely decreased MTHFR activity. There is currently no published data on the combined impact of *COMT* and *MTHFR* on progression of scoliosis in patients with adolescent idiopathic scoliosis (AIS).

Objective (s)

To determine if variants associated with low COMT and MTHFR activity are associated with AIS progression.

Study Design

Retrospective cohort study

Methods

Patients with AIS, at least two Cobb angle measurements and who received *COMT* rs4680, *MTHFR* rs18001131 (A1298C), and *MTHFR* rs1801133 testing were screened. Two predetermined groups for analysis were as follows: Group 1 had both low COMT activity (rs4680 AA genotype) and low MTHFR activity, which was defined as less than 50% activity by the following genotype combinations: rs1801131 AC and rs1801133 CT; rs1801131 AA and rs1801133 TT. Group 2 had intermediate or high COMT activity (rs4680 AG or GG genotypes) and not low MTHFR activity, defined as the following genotype combinations: rs1801131 AA and rs1801133 CT; rs1801131 AC and rs1801133 CC; rs1801131 AA and rs1801133 CC. Individuals with a diagnosis of that would characterize the scoliosis as neuromuscular or syndromic and either low COMT or low MTHFR activity but not both were excluded. The primary outcome was progression of scoliosis, which was defined as an increase in the Cobb angle of at least 20 degrees or requiring spinal surgery between the time of diagnosis and skeletal maturity. Group 1 and Group 2 outcomes were analyzed via a Chi-square test.

Results

One hundred two patients with AIS diagnosis and required Cobb angle measurements had both COMT and MTHFR testing. Forty one (40.2%) of these patients had both low COMT (rs4860 AA) and MTHFR activity (Group 1), 30.4% (31/102) had intermediate or normal activity of both genes (Group 2), and 29.4% (30/102) were excluded from analysis due to low activity for either genes but not both. A majority of patients were females with 29/41 (70.7%) in Group 1 and 22/31 (70.7%) in Group 2. All patients were Caucasian. In regards to the primary outcome, 78.0% (32/41) in Group 1 had progression versus 48.4% (15/31) of patients in Group 2 (p=0.009).

Conclusion and significance

Significantly more patients with both low COMT and low MTHFR activity had progression of AIS than those with intermediate or normal activity of COMT and MTHFR. Understanding the role of these genetic variants may inform future research in precision medicine regarding adjuvant treatment modalities tailored based on COMT and MTHFR results such as antidepressants, or folic acid, respectively, to decrease scoliosis progression.

O50

THE MORPHOLOGICAL DISCREPANCY OF NEUROMUSCULAR JUNCTIONS FROM BILATERAL PARASPINAL MUSCLES IN ADOLESCENT IDIOPATHIC SCOLIOSIS: A QUANTITATIVE IMMUNOFLUORESCENCE ASSAY

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Introduction

Prior studies suggest neuromuscular factors, such as abnormalities of central nervous system (CNS) and asymmetry of bilateral paraspinal muscles (PSMs), may be involved in the pathogenesis of adolescent idiopathic scoliosis (AIS). The neuromuscular junction (NMJ) is the important pivot where the CNS interacts with muscle fibers, but this has not been well characterized in the PSM of AIS.

Objective (s)

To perform the quantitative morphological analysis of the NMJs from bilateral PSMs in AIS.

Study Design

A prospective controlled basic study using PSM samples.

Methods

AIS patients who received posterior spinal fusion in our center were prospectively enrolled in this study. Meanwhile, age-matched congenital scoliosis (CS) patients and non-scoliosis patients were also included as controls. Fresh samples of PSMs were harvested intraoperatively and immediately fixed in 4% paraformaldehyde. NMJs were immunolabelled using antibodies against neurofilament and synaptic vesicle to reveal pre-synaptic neuronal architecture, and α-bungarotoxin to reveal post-synaptic motor endplates. A confocal microscope was used to acquire z-stack projections of NMJs images. Then, NMJs images were analyzed and measured on maximum intensity projections using ImageJ software. The morphology of NMJs was quantitatively measured by a standardized NMJ-morph workflow. A total of 21 variables, including pre- and post-synaptic variables, were measured and compared between different groups.

Results

The baseline information of patients in three groups showed no significantly different. For AIS group, the NMJs in the convex side of PSM demonstrated obvious decrease of overlap when compared to the concave side (48.11%±10.31% vs. 34.27%±8.09%, P=0.0036), which means less degrees of congruence between the pre- and post-synaptic elements. Besides, the convex side has significantly larger AChR area in comparison with the concave side. However, these two variables show no statistical difference between the concave and convex side in CS patients. In contrast with non-scoliosis controls, both the convex and concave side of AIS patients demonstrate significantly smaller muscle fiber diameters (all P<0.0001).

Conclusion and significance

The present study elucidates the morphological features of the NMJs from bilateral PSMs in AIS. The NMJs in the convex side show smaller overlap between the pre- and post-synaptic parts compared to the concave side. This study proves evidence that NMJs may contribute to the mechanisms of AIS. The decreased overlap in the convex side reflects the asymmetrical neuromuscular activity in the bilateral PSMs of AIS and may be the primary cause driving scoliosis. Besides, it could be considered as a novel potential therapeutic target for the treatment of progressive AIS.

O51

HOSPITAL OUTCOMES IN THE POSTOPERATIVE PERIOD OF NEUROMUSCULAR SCOLIOSIS: RELATIONSHIP BETWEEN CLINICAL EVENTS, EARLY MOBILITY AND LENGTH OF STAY.

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Introduction

It is known that 94% of patients, undergoing correction of neuromuscular scoliosis may present some type of complication in the early postoperative period and this high potential for complications is due to the comorbidities and history of these patients. Understanding the clinical outcomes, including complications inherent to this profile, such as immobilization, can minimize the risks in this line of care. The literature is not clear about the impact of immobility or reduced intra-hospital mobility on this patient profile, and its relationships with clinical trajectory and length of stay.

Objective (s)

The aim of study was to evaluate the relationship between achieving proposed mobility goals with in-hospital clinical events and the length of stay of patients undergoing surgical correction of neuromuscular scoliosis.

Study Design

Observational cohort retrospective.

Methods

Data were collected from the medical records of 125 patients undergoing neuromuscular scoliosis correction at an orthopedic hospital in São Paulo, operated between January 2021 and March 2022. Personal and hospital data were collected, such as 1. Achievement of mobility goals proposed (goal 1: sitting in bed up to 60°, goal 2: sitting out of bed or walking, if it is an ambulatory patient and goal 3: train patients/families about assisted transfers and home care), 2. Clinical events occurred and 3. Length of hospital stay. It was analyzed which clinical events were mobility barriers to achieving the proposed goals and what the relationships between complications and intra-hospital mobility were with the patients' length of stay.

Results

Almost a third of patients (33%) did not meet any proposed mobility goal, with sitting out of bed on the 2nd post-operative day being the least achieved at 32%. The main barriers to achieving the mobility target were hemodynamic (46.8) and respiratory (25%) events. It was observed that respiratory complications had a significant relationship with non-compliance with proposed mobility goals (goal 1

p=0.021, goal 2: p=0.007, goal 3 p= 0.043) (Table 1), with patients with less success in achieving any mobility target stayed more days in the ICU (p≤0.001). Regarding total hospitalization time, patients who did not meet the 2nd post-operative goal - sitting out of bed (p=0.014) and did not meet the 3rd post-operative goal - training assisted transfers) p= 0.032 had more days of hospitalization total hospital when compared to those that met the proposed goals.

Table 1 - Relationship between mobility goals and the occurrence of clinical event/barriers to achieving

		N	Presence of clinical event % (CI95%)	Presence of clinical event % (CI95%)	p-value
General events	**Goal 1st - PO**				
	Not achieved	42	19,05 (9-32)	80,95 (67-90)	0,05
	Achieved	84	38,1 (28-48)	61,9 (51-71)	
	Goal 2st - PO				
	Not achieved	32	15,63 (6-30)	84,38 (69-93)	0,04
	Achieved	94	37,23 (27-47)	62,77 (52-72)	
	Goal 3st - PO				
	Not achieved	52	17,31 (8-29)	82,69 (70-91)	0,006
	Achieved	74	41,89 (31-53)	58,11 (46-68)	
Respiratory events	**Goal 1st - PO**				
	Not achieved	42	50 (35-64)	50 (35-64)	0,021
	Achieved	84	72,62 (62-81)	27,38 (18-37)	
	Goal 2st - PO				
	Not achieved	31	45,16 (28-62)	54,84 (37-71)	0,007
	Achieved	94	72,34 (62-80)	27,66 (19-37)	
	Goal 3st - PO				
	Not achieved	52	53,85 (40-66)	46,15 (33-59)	0,043
	Achieved	74	72,97 (62-82)	27,03 (17-37)	
Hemodynamics events	**Goal 1st - PO**				
	Not achieved	42	59,52 (44-73)	40,48 (26-55)	0,388
	Achieved	84	69,05 (58-78)	30,95 (21-41)	
	Goal 2st - PO				
	Not achieved	42	54,84 (37-71)	45,16 (28-62)	0,266
	Achieved	94	69,15 (59-77)	30,85 (22-40)	
	Goal 3st - PO				
	Not achieved	52	55,77 (42-68)	44,23 (31-57)	0,070
	Achieved	64	72,97 (62-82)	27,03 (17-37)	
Gastrointestinal events	**Goal 1st - PO**				
	Not achieved	42	88,1 (75-95)	11,9 (4-24)	0,748
	Achieved	84	91,67 (84-96)	8,33 (3-15)	
	Goal 2st - PO				
	Not achieved	32	90,63 (77-97)	9,38 (2-22)	1
	Achieved	94	90,43 (83-95)	9,57 (4-16)	
	Goal 3st - PO				
	Not achieved	52	92,31 (82-97)	7,69 (2-17)	0,780
	Achieved	74	89,19 (80-94)	10,81 (5-19)	

Other events	**Goal 1st - PO**				
	Not achieved	42	92,86 (82-97)	7,14 (2-17)	1
	Achieved	84	94,05 (87-97)	5,95 (2-12)	
	Goal 2st - PO				
	Not achieved	32	96,88 (86-99)	3,13 (0,34-13)	0,655
	Achieved	94	92,55 (85-96)	7,45 (3-14)	
	Goal 3st - PO				
	Not achieved	52	90,38 (80,2-96,24)	9,62 (3-19)	0,374
	Achieved	74	95,95 (89,58-98,85)	4,05 (1-10)	
Neurological events	**Goal 1st - PO**				
	Not achieved	42	97,62 (89-99)	2,38 (0,26-10)	0,872
	Achieved	84	95,24 (89-98)	4,76 (1-10)	
	Goal 2st - PO				
	Not achieved	32	96,88 (86-99)	3,13 (0,34-13)	1
	Achieved	94	95,74 (90-98)	4,26 (1-9)	
	Goal 3st - PO				
	Not achieved	52	96,15 (88-99)	3,85 (0,81-11)	1
	Achieved	74	95,95 (89-98)	4,05 (1-10)	
Infectious events	**Goal 1st - PO**				
	Not achieved	42	83,33 (70,04-92,22)	16,67 (7-29)	0,930
	Achieved	84	85,71 (77,07-91,95)	14,29 (8-22)	
	Goal 2st - PO				
	Not achieved	32	81,25 (65-91)	18,75 (8-34)	0,700
	Achieved	94	86,17 (78-92)	13,83 (7-21)	
	Goal 3st - PO				
	Not achieved	52	80,77 (68-89)	19,23 (10-31)	0,402
	Achieved	74	87,84 (78-93)	12,16 (6-21)	
Death events	**Goal 1st - PO**				
	Not achieved	42	97,62 (89-99)	2,38 (0,26-10,59)	1
	Achieved	84	98,81 (94-99)	1,19 (0,13-5)	
	Goal 2st - PO				
	Not achieved	32	93,75 (81-98)	6,25 (1-18)	0,104
	Achieved	94	100 (100-100)	0 (0-0)	
	Goal 3st - PO				
	Not achieved	52	96,15 (88-99)	3,85 (0,81-11)	0,329
	Achieved	74	100 (100-100)	0 (0-0)	

*Post operative: PO

Conclusion and significance

Achieving planned early mobility goals was related to shorter ICU stays and total hospitalization, with respiratory events being the main barriers to planned mobility in this study. However, it highlights the importance of implementing multidisciplinary mobility protocols and studies on the topic in this line of care.

O52

FIVE DAYS OF SCOLIOSIS-SPECIFIC EXERCISES IMPROVE PREOPERATIVE SPINAL FLEXIBILITY IN PATIENTS WITH RIGID ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

The spinal flexibility determines what can be corrected intraoperatively. For cases with stiffer curves, a period of stretching exercises may be beneficial to improve flexibility. Scoliosis-specific exercise (SSE) uses active spine-lengthening in the longitudinal direction, as well as diagonal stretching exercises coupled with rotational breathing, to mobilize the deformed ribcage. Thus, SSE has potential utility in altering spinal flexibility.

Objective (s)

This study aims to report the effect of a novel technique, a structured SSE program, in improving preoperative spinal flexibility of patients with stiff scoliosis. We hypothesize that a 5-day long preoperative SSE program can improve spinal flexibility therefore enhancing operative curve correction.

Study Design

a prospective case-series study

Methods

This case-series investigated the effects of 5 days of scoliosis-specific exercise (SSE) in improving spinal flexibility of patients with adolescent idiopathic scoliosis before surgery. Sixty-two cases were studied, in which forty-two patients (age: 15 ± 1.6 years, 36 girls and 6 boys, Cobb angle: 64 ± 11°) with scoliosis in their thoracic spine undertook spinal fusion were consecutively recruited in 2020 (prospective cohort), whilst a historical cohort of operated patients with rigid scoliosis and without preoperative SSE program (n=20, operation performed between 2017 and 2019) was retrieved. Rigid scoliosis was defined as a reduction of Cobb angle < 50% between the preoperative fulcrum-bending and the initial standing curve magnitude. In the prospective cohort, 20 patients (Cobb angle: 65 ± 11°) presented having rigid thoracic scoliosis (pre-SSE fulcrum bending: 40 ± 9°, 39% reduction) and undertook 5-day SSE to improve preoperative spinal flexibility (SSE cohort), while 22 patients (Cobb angle: 63 ± 12°) presented with flexible thoracic curvatures (pre-SSE fulcrum bending: 27 ± 8°, 58% reduction) undertook surgery without preoperative SSE (non-SSE cohort). The preoperative 5-day SSE, 4-hour each day, adopted the International Schroth 3-dimensional Scoliosis Therapy (ISST) technique with inpatient model in this study.

Results

After 5 days of SSE, improvements of Cobb angle with post-SSE fulcrum-bending radiograph (23 ± 7°, 66% reduction) and pulmonary function (pre-SSE: forced expiratory volume in 1 second [FEV1]/forced expiratory volume [FVC]=87% vs post-SSE: FEV1/FVC=92%, p<0.01) were observed. At postoperative day-5, scoliosis reduced by 44 ± 6.6° to a residual 22 ± 6° in the SSE cohort (standing curve magnitude), which was 1° less than the Cobb angle with post-SSE fulcrum-bending radiograph. In the non-SSE cohort, scoliosis reduced by 37 ± 6.3° to 26 ± 5.7°. This postoperative correction was maintained without adding-on at the 2-year follow-up. SSE cohort showed a distinct greater correction (66% vs 57%), shorter hospitalization (10±2 days vs 15±6 days) and lower pain score (3/10 vs 7/10) compared to the historical cohort with rigid scoliosis.

Conclusion and significance

Our finding implies that 5 days of SSE program improve the preoperative spinal flexibility and therefore facilitating operative curve correction.

O53

CONCURRENT VALIDITY AND DIAGNOSTIC ACCURACY OF THE DIPA-S© EHEALTH CAPTURE AND ANALYSIS SYSTEM FOR THE ASSESSMENT OF PATIENTS WITH SCOLIOSIS THROUGH TELECONSULTATION

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Introduction

A growing trend towards new ways of assessing patients with scoliosis in the digital environment and aiming for greater reliability in teleconsultation appointments is happening. The development of assessment tools that do not require in-person presence has been gaining traction; however, there is still a gap in the literature regarding studies on the validity and diagnostic accuracy of new instruments.

Objective (s)

This study aimed to evaluate concurrent validity and diagnostic accuracy, determining cutoff points to detect scoliosis for variables obtained by the DIPA-S© eHealth capture and analysis system compared to in-person clinical assessment.

Study Design

Cross-sectional diagnostic accuracy study.

Methods

This study was conducted between December 2022 and April 2023 in a private clinic. The patients were invited to participate during the first visit or regular physiotherapy appointment. Eligibility criteria included age between 7 and 25 years old, the ability to stand independently, and leg length discrepancy less than 2 cm. Participants were excluded if they had undergone spine surgery, lower limb amputation, or any diagnosable cause of scoliosis. Each participant underwent two procedures: in-person clinical assessment measuring the frontal trunk imbalance (i-pFTI) and sagittal trunk imbalance (i-pSTI) (in millimeters) and the angle of trunk rotation (i-pATR) (in degrees) and using the DIPA-S© app measuring FTI, STI, and ATR. The in-person assessment was performed by an experienced physiotherapist, while the capture of images using the DIPA-S© app was performed by a different person (parents, physiotherapist, or surgeon) one of three. All analyses were performed using the DIPA-S© analysis software by the same physiotherapist after the data collection period and blinded to results from in-person. For statistical purposes, correlation tests, Bland Altman and the RMS error was calculated. The ROC curve was performed using the scoliometer as reference with a cutoff ≥7° ($p < 0.05$).

Results

The sample consisted of 68 patients, 69% girls. The mean age was 13.9±4 years, with a mean Cobb angle of 29.1°±18.5° including 56% of thoracic curves. The correlation ranged from moderate to very high (0.6, 0.7, and 0.9), with low values of RMS error (10 mm, 20 mm, and 4°) for the FTI, STI, and ATR measurements, respectively. The AUC was excellent (97%; p<0.001) only for the ATR measured using the DIPA-S© app with a cutoff point of 4° (Se = 96%; Sp = 95%).

Conclusion and significance

The DIPA-S© app produces valid measurements of postural variables in the frontal (FTI), sagittal (STI) and axial (ATR) planes through teleconsultation and has diagnostic accuracy for ATR measurement (cutoff point of 4°). With this system, image capture can be performed at home by parents or caregivers using the mobile application, and professionals can analyze the images using the software, enabling a complete remote assessment.

O54

ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) TREATMENT, COMBINING IN-PERSON AND ONLINE SESSIONS, CAN INCREASE COMPLIANCE, ENHANCE EFFECTIVENESS, AND IMPROVE MONITORING OF PATIENTS WITH TRANSPORTATION BARRIERS TO HEALTHCARE ACCESS

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Introduction

Based on the current literature, one of the most important prognostic factors for a successful result in AIS treatment with Physiotherapeutic Scoliosis Specific Exercises (PSSE) is compliance. However, many patients living away from specialized centers, have travelling and financial obstacles to receive proper care and the lack of motivation can lead to poor results. Our clinic has developed a specific protocol for online evaluation and treatment sessions.

Objective (s)

The aim of our study was to evaluate the effectiveness of our telehealth protocol, in patients with difficulty to access our clinic for in-person treatment.

Study Design

Retrospective matched case-control study

Methods

Our online evaluation required patient digital past and recent radiographs and eight standardized clinical photos, in all directions of standing and forward bending positions, so that an acurate clinical and radiological assessment could be achieved even before the first in-person visit. An intensive week in-person program was prescribed, to allow adequate teaching of PSSE-Schroth exercises (videotaped) or brace manufacturing when needed. Then, the patients followed a home-program of exercises, having an online supervised session once a week with our therapists, while any addition/modification to exercise program was videotaped again. They were asked to send us standardized clinical photos and somatometric measurements every month and to re-visit our clinic in-person every 3-6 months, based on curve prognosis and treatment plan.

Our online intervention group (OIG) (combined in-person and online treatment) was consisted of 118 patients (103 females-15 males, mean Cobb angle 29.4°, Risser 0.8, age 12.6 years). Our inclusion criteria were Cobb angle $10° - 40°$, Risser 0-2, < 1-year post-menarche for girls, and permanent residence outside Attica region in Greece. We used a retrospective matched-control group (MCG) with similar characteristics that received only in-person treatment but also permanently living outside Attica (106 patients, 92 females-14 males, mean Cobb angle 27.1°, Risser 1.1, age 12.9 years). In the last 3
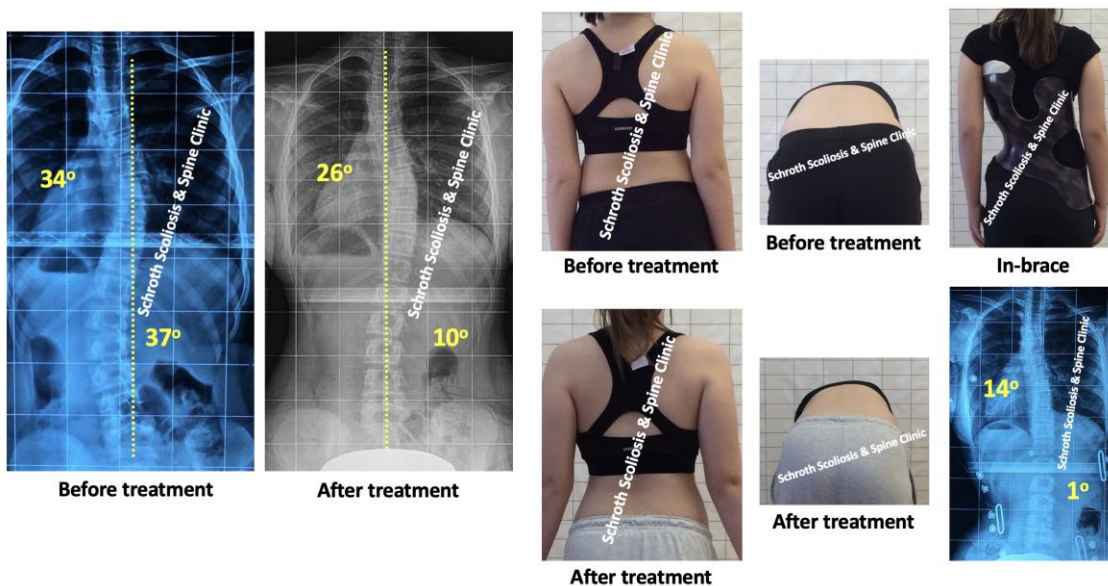
years totally 3092 online sessions were done for the OIG. Compliance was self-reported in both groups. Paired sample t-test were used for statistical analysis.

Before treatment — After treatment

Before treatment

In-brace

After treatment

After treatment

Results

Compliance with exercises was significantly better (p=0.006) in OIG (78.3% > 3 days/week) compared to MCG (52.8% > 3 days/week). In OIG 35% improved, 54% remained stable and 11% progressed, while in MCG was significantly lower with 24% improved, 57% stable and 19% progressed (p=0.04). The lost to follow-up was also significantly lower (p=0.03) in the OIG (6 subjects, 5.1%) compared to MCG (10 subjects, 10.9%).

Before treatment — After treatment

Before treatment

In-brace

After treatment

After treatment

Conclusion and significance

A combination of in-person and online treatment is effective to monitor and treat AIS patients at high risk of progression. Our telehealth protocol significantly improved compliance, monitoring, and final treatment result. Online supervision is important to keep patient's motivation and to allow proper follow-up and can be proposed for patients with transportation barriers.

O55

TAILBONE'S ACTIVE GRAVITATIONAL CONTROL: A QUANTITATIVE ANALYSIS OF THE COMBINED EFFECT OF THE JI METHOD AND PVC SOFT BALL ON SCOLIOSIS CORRECTION

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Introduction

The coccyx plays a crucial role in the interaction with gravity at the lower end of the spine. In patients with scoliosis, improper gravitational control of the coccyx can lead to asymmetric spinal loading, exacerbating the condition. This study investigates how the Ji Method, utilizing a 12.5cm diameter PVC soft ball, enhances the coccyx's gravitational control ability and affects spinal alignment in patients with scoliosis.

Objective (s)

The purpose of this study is to strengthen the coccyx's ability to adjust posture in response to gravity using Ji Method exercises combined with a PVC soft ball and to quantitatively assess the improvements in spinal angle and alignment in scoliosis patients.

Study Design

This observational cohort study involved 60 scoliosis patients participating in a 12-week Ji Method program. The program included exercises using a PVC soft ball, focusing on the enhancement of coccygeal gravitational control.

Methods

Sixty scoliosis patients participated in a 12-week Ji Method program. The regimen included coccyx gravitational control exercises using a PVC soft ball. Spinal angles were measured with a 3D spinal alignment scanner, and muscle strength changes were assessed with electromyography (EMG). Pain scores and self-reported posture improvements were also recorded.

Results

Post-program, participants showed an average reduction in spinal angle of 6.5 degrees (34% improvement) in the 15-20 degree group, 9.2 degrees (26% improvement) in the 21-35 degree group, and 11.3 degrees (25% improvement) in the 36-45 degree group. The coccyx exercises with the PVC soft ball resulted in an average increase of 50% in muscle activation around the coccyx ($p<0.01$). Self-reported posture improvements were reported by over 90% of participants, and pain scores decreased from an average of 7.5 to 2.1 across all groups ($p<0.001$).

Conclusion and significance

Exercises using the PVC soft ball as part of the Ji Method significantly impact the enhancement of coccyx's gravitational control ability, leading to improved spinal alignment in scoliosis patients. This approach could play an important role in the non-surgical management of scoliosis and contribute to long-term posture correction and spinal health promotion.

O56

INTENSIVE BRACING MANAGEMENT COMBINED WITH PHYSIOTHERAPEUTIC SCOLIOSIS-SPECIFIC EXERCISDES FOR ADOLESCENT IDIOPATHIC SCOLIOSIS PATIENTS WITH 40-60° MAJOR CURVES WHO REFUSED SURGERY.

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Introduction

Current guidelines for brace management of adolescent idiopathic scoliosis (AIS) are mostly recommended for curves between 25° to 40°. For AIS patients with curves >40°, surgery is often considered since bracing may be less effective; however, there are still some patients and families who refuse operation. Therefore, further research is necessary to determine optimal bracing management in this group. To date, few protocols for such have been reported in literature.

Objective (s)

The aim of this study was to introduce and evaluate the effectiveness of the treatment protocol comprising of intensive bracing management and physiotherapeutic scoliosis-specific exercises (PSSE) in AIS patients with a major curve of 40-60° who refuse surgery.

Study Design

A prospective cohort study.

Methods

10-18-year-old AIS patients having 40-60°curves and a Risser grade of 0-3, but firmly refusing surgery were eligible. Patients who had a proximal thoracic curve or had undergone any other form of treatment previously were excluded from the study. A total of 82 patients were recruited and received the treatment. The primary outcome was defined as "success" when the main curve was below 50° upon reaching skeletal maturity, and "failure" if otherwise. The secondary outcome was defined as improved (>5° reduction), unchanged (≤5° change) or progressed (>5° increase) based on the evolution of the main curve. The per protocol (PP) and intent to treat (ITT) analyses were performed to quantify success rates, while the dropouts were considered as failures. Risk factors associated with bracing failure were identified and a receiver operating characteristic (ROC) curve was used to determine the cut-off value.

Results

A total of 77 patients completed the treatment, while 5 dropped out. The average main curve was 47.40±5.93° at baseline and 38.56±11.85° at last follow-up (P<0.001). Our management was successful in 83% and 78% of patients based on the PP and ITT analyses, respectively. When compared with the curve magnitude at baseline, 65% patients improved, 30% remained unchanged, and 5% progressed when using a 5° threshold. Univariate comparison and logistic regression analysis demonstrated that patients with successful outcomes had a significantly smaller baseline curve, larger Risser Stage, and larger in-brace correction (IBC) rate.

Conclusion and significance

For AIS patients with 40-60° curves who refused surgery, our intensive bracing management along with PSSE was practical and effective, achieving success in 78% of patients based on an ITT analysis. A larger baseline curve, smaller Risser Stage, and smaller IBC rate were associated with treatment failure. Our intensive management provides new insights into improving the effectiveness of bracing in patients with AIS who refuse surgery. This is a promising option for patients with 40-60° curves, since their scoliosis may be treated using a non-surgical technique instead of surgery in the future.

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A Comparison of Bracing to Casting for Infantile Idiopathic Scoliosis

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Introduction

The standard treatment for Infantile Idiopathic Scoliosis (IIS) has been serial Mehta casting under general anesthesia (GA) during the first years of a child's life. However, concerns about the effects of GA on brain development in children under the age of three have led to the exploration of alternative treatments. One such treatment is custom bracing, offering a non-sedative option.

Objective (s)

This study aimed to compare the outcomes of customized bracing and casting, examining bracing as an alternative treatment to casting for IIS.

Study Design

Retrospective cohort study

Methods

A retrospective series of 24 IIS patients with a minimum of two years of brace or cast treatment was reviewed. Casting was performed under GA, while brace fitting did not require sedation. Our clinical practice for IIS evolved from casting to bracing, resulting in the identification of three cohorts: cast only (CO), initial casting switched to bracing during treatment (CB), and brace only (BO). Radiographs were compared at baseline, 12 months, 24 months, and the most recent visit. Brace compliance to a 16-22 hours/day prescription was assessed by a thermal sensor. We examined curve magnitude, brace wear duration, and complications, assessing group differences with Krushkal-Wallis tests and post-hoc pairwise comparisons for measures exhibiting significant differences, adjusting p-values using Bonferroni correction.

Results

The cohort included 12 CO, 7 BO, and 5 CB patients. Differences in age or Cobb angles at treatment initiation were not statistically significant. CB patients experienced larger decreases in the median Cobb angle at the 12-month (-26° vs -9° and -12°, p=0.002) and 24-month (-29° vs -16°, p=0.01) visits compared to BO or CO patients. No statistically significant differences were observed in the Cobb angles across the three groups at the 12-month, 24-month, and most recent follow-up. At 24 months, Cobb angle was < 20° in 33% CO, 80% BO, and 86% CB patients.

Abstracts

Median brace compliance of the cohort stayed above 80% at all follow-up appointments. At 6 months, the median brace wear time was 21 hours/day, which decreased to 19 hours/day at the 1-year follow-up. The median remained 18 hours/day at the 18-month follow-up before rising to 20 hours/day at the 2-year follow-up visit.

Skin breakdown was experienced by 11 patients (33% CO, 40% BO, 71% CB). Skin irritation was solely observed in CO patients. Rib constriction and feeding issues were not observed in BO patients. Complications were not associated with brace compliance (p>0.05).

Table 1: Summary of Cobb angles by treatment group at each visit

	Overall (N=24)[1]	Casting Only (N=12)[1]	Bracing Only (N=5)[1]	Casting then Bracing (N=7)[1]	p-value[2]
Age at initial treatment (months)	21.4 (11.6)	25.7 (13.5)	15.6 (2.9)	18.1 (9.9)	0.1
Pre-treatment Cobb angle (°)	38 (15, 72)	47 (15, 72)	32 (30, 36)	40 (30, 67)	0.2
Post-treatment Cobb angle (°)					
1st brace/cast appointment (supine)	14 (0, 38)	16 (4, 32)	14 (0, 23)	10 (4, 38)	0.7
12 months	23 (5, 74)	30 (6, 74)	23 (14, 39)	15 (5, 33)	0.1
24 months	19 (2, 85)	27 (5, 85)	18 (13, 35)	10 (2, 35)	0.1
Most recent appointment	14 (2, 92)	26 (2, 92)	12 (3, 34)	10 (2, 42)	0.2
Change in Cobb angle (°)					
12 months	-14 (-37, 4)	-12 (-26, 2)	-9 (-18, 4)	-26 (-37, -18)	0.002
24 months	-19 (-41, 13)	-16 (-28, 13)	-16 (-23, 5)	-29 (-41, -21)	0.01
Most recent appointment	-20 (-46, 20)	-12 (-36, 20)	-21 (-29, 4)	-25 (-46, -20)	0.1

[1]Mean (SD) and Median (Range)
[2]Statistical test conducted: Kruskal-Wallis Rank Sum Test

Conclusion and significance

Custom bracing yielded a successful decrease in curve magnitude following two years of compliance. The results were comparable to those achieved with casting, suggesting custom bracing may be an effective and safe alternative to serial casting. Furthermore, there is potential for integrating bracing with casting protocols to minimize GA required in the treatment process.

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AUTOMATED DESIGN OF BRACES FOR THE TREATMENT OF ADOLESCENT IDIOPATHIC SCOLIOSIS USING A SHAPE OPTIMIZATION ALGORITHM

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Introduction

Adolescent idiopathic scoliosis is a three-dimensional (3D) deformation of the spine that tends to progress during growth, the moderate forms of which require a brace treatment. To this day, brace design has been rooted in empirical processes with insufficient standardization. As such, a brace's effectiveness depends heavily on the treating orthotist's expertise, resulting in a significant variability in reported outcomes.

Objective (s)

Develop and validate a new automated approach for brace design to treat adolescent idiopathic scoliosis, optimizing immediate and two-year correction.

Study Design

Prospective feasibility study

Methods

Seventeen patients requiring a brace were prospectively recruited. For each, a personalized finite element model (FEM) was created from biplanar radiographs and a surface topography torso scan, and was used to simulate the immediate in-brace correction and the resulting two-year growth modulation. An automatically generated brace shape was iteratively modified and simulated by a global optimization algorithm using this patient-specific FEM, to maximize immediate and two-year 3D correction while respecting a cutaneous pressure threshold. Each optimized brace output from this automated process was verified by an expert orthotist, manufactured as is, and fitted on the patient. The immediate correction was measured using a coronal radiograph.

Results

All 17 optimized braces were approved by the expert orthotist and fitted on patients without any modifications. On average, the immediate measured correction of the main curve's Cobb angle was 82±23% (70±28% thoracic and 90±15% lumbar). The simulated lumbar lordosis improved by 5±3°, and thoracic axial apical rotation corrected by 2±3°.

Conclusion and significance

Our automated design method generated effective braces with immediate corrections equivalent to or better than those reported in the literature. The proposed approach allows for rational automation of brace design via a personalized biomechanical optimization, and its feasibility in a clinical setting has been demonstrated. Its integration in clinical practice could simplify orthotists' work and reduce the dependency between brace efficacy and orthotist expertise.

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IMMEDIATE EFFICACY OF BRACES GENERATED AUTOMATICALLY BY A SHAPE OPTIMIZATION ALGORITHM TO TREAT ADOLESCENT IDIOPATHIC SCOLIOSIS: A RANDOMIZED CONTROLLED TRIAL.

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Introduction

Computer-aided design and manufacturing (CAD/CAM) methods for brace design and manufacturing are becoming increasingly used. Linked to CAD/CAM and 3D radiographic reconstruction techniques, we developed a finite element model (FEM) enabling to simulate the brace effectiveness before its fabrication, as well as an automatic design processes.

Objective (s)

To compare and validate the efficacy of our proposed automated brace design algorithm on nighttime braces to treat adolescent idiopathic scoliosis.

Study Design

Single centre, crossover, double blinded randomized control trial.

Methods

Fifty-eight patients with AIS aged between 10 to 16-years and skeletally immature were recruited at the CHU Sainte-Justine. All patients received both a nighttime brace optimized by the automatic algorithm leveraging a patient-specific FEM (Test) and a conventional Providence-type brace (Control). Radiographs were taken for each patient with both braces in a randomized crossover approach to evaluate immediate in-brace correction. The outcomes were the non-inferior immediate in-brace correction.

Results

Fifty-six patients received the Test brace and the Control brace. The initial Cobb angle was 21°± 3° in the thoracic region (MT) and 22°± 3° in the thoracolumbar/lumbar region (TL/L). The immediate MT correction in the brace was 56±15% (Test group) and 59±17% (Control group). In TL/L, the immediate correction was 76±7% (Test group) and 78±7% (Control group). The immediate correction in the Test brace was not inferior to that of the Control brace ($p<0.001$). The order in which the braces were tested did not have a significant residual effect on the immediate correction.

Conclusion and significance

The proposed automated shape optimization method proves to be clinically relevant, allowing for immediate in-brace correction equivalent to that of braces designed by expert orthotists with decades of experience. Patient follow-up will continue, and the treatment results at 2 years will be reviewed. This method's integration in clinical practice could help simplify orthotists' work, serve regions with limited access to expertise, and standardize brace design according to a patient's unique biomechanics.

O60

THE RELIABILITY OF THE C7-SACRAL LASER LINE MEASUREMENT AS A CLINICAL MEASURE OF SCOLIOSIS

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Introduction

Scoliosis is a condition characterized by an abnormal axial rotation and/or lateral curvature to the spine greater than ten degrees with x-ray measurement. However, in physical therapy clinics with no x-ray access, clinicians often rely on the C7-Sacral Laser Line (C7-SLLM) measurement, which assesses the clinical coronal plane deviation of the trunk. The reliability of this tool has never been reported.

Objective (s)

The purpose of this study was to determine the intra and inter-rater reliability of the C7-SLLM in subjects, both with and without scoliosis. Given that the C7-SLLM involves a degree of subjectivity with palpating and correctly identifying landmarks, we hypothesized that the intra-rater reliability would be excellent and the inter-rater reliability would be poor.

Study Design

Measurement Study

Methods

The sample included 33 subjects within the ages of 22-43 who could hold an upright standing posture for at least 10 minutes. Of those tested, 8 subjects had a diagnosis of scoliosis. An expert and novice rater performed the C7-SLLM for each subject. Each rater placed two circular stickers on the spinous process of the subject's seventh cervical vertebra (C7 spinous process) and the spinous process of the 2nd sacral vertebra (S2 spinous process). A vertical leveling laser was then placed on the floor behind the participant and projected onto their S2. The rater then measured the horizontal distance in mm that the C7 marker deviated from the vertical laser line (Figure 1). The measurement was repeated three times by each rater. Each rater was blinded from the other's measurement. Intraclass correlation coefficients (ICC's) were used to analyze the intra- and inter-rater reliability for the groups with and without scoliosis separately.

Results

In the group with scoliosis, intra-rater reliability for both the expert and novice raters was excellent, (ICC for expert rater = .993, ICC for novice rater = .988, ps < .001). Similarly, in the group without scoliosis, intra-rater reliability for both the expert and novice raters was excellent (ICC for expert rater = .968, ICC

for novice rater = .955, ps < .001). Inter-rater reliability for the group with scoliosis was excellent, (ICC = .951, p<.001), but inter-rater reliability for the group without scoliosis was good, (ICC = .788, p<.001).

Conclusion and significance

This study demonstrated that the C7-SLLM had excellent to good intra-rater and inter-rater reliability with a limited group of adult subjects with and without scoliosis. This study provides a foundation for future studies that may explore the validity of the C7-SLLM in efforts to establish the utility of this measurement tool as a valid and reliable outcome measure for use in the conservative management of scoliosis. Further research with a larger sample size, increased time between intra-rater measurements, and inclusion of an adolescent population would be valuable.

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CAN CLINICAL EVALUATION TOOLS PREDICT CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS? A CORRELATIONAL STUDY&NBSP;

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Introduction

The gold standard for diagnosis and monitoring of Adolescent Idiopathic Scoliosis (AIS) patients is Cobb angle. However, due to high exposure to radiation, alternative clinical evaluation tools have been proposed for follow-up. Few studies have evaluated the ability of clinical measurements to predict radiological changes.

Objective (s)

Our study aimed to determine the relation between Cobb angle, Angle of Trunk Rotation (ATR) and photographic parameters, like Anterior Trunk Symmetry Index (ATSI) and Posterior Trunk Symmetry Index (POTSI), by identifying if clinical changes can predict post-treatment radiological difference.

Study Design

Retrospective correlational study

Methods

We included 78 subjects (56 females, 22 males) aged 8-17 years with idiopathic scoliosis. For each subject Cobb angle and ATR by Bunnel Scoliometer were measured. Additionally, ATSI and POTSI were calculated by front and back photos. Mean Thoracic (Th) Cobb angle was 27.8°±15.31° and Lumbar (Lu) 26.7°±11.8°, Th ATR 7.38°±4.19° and Lu ATR 6.49°±3.45°. All subjects received conservative treatment, either only Physiotherapeutic Scoliosis Specific Exercises (PSSE) or brace with PSSE. The comparison between radiological and clinical parameters was performed before and after intervention. Statistical analysis was performed using Pearson correlation coefficient and paired t-test.

Results

Mean Cobb angle Difference (D) Th post-treatment was 0.22° (p=0.79), Lu D 0.64° (p=0.46). Only D ATR Lu (0.69°, p=0.01) and D ATSI (4.28, p=0.04) were significantly changed after treatment. In total, 13 Th

curves and 16 Lu curves improved > 5°, while 11 Th and 7 Lu progressed > 5°. In 41/47 (87.2%) curves when Cobb angle progressed or improved, it was predicted by ATR change. ATSI predicted Cobb change in 28/40 (70%) subjects and POTSI in 17/40 (42.5%).

For baseline data, moderate correlation was found for Cobb angle Lu and ATR Lu (r=0.400, p=0.001) and for ATSI with POTSI (r=0.423, p=0.001). Post-treatment ATR Lu was moderately correlated with post ATSI (r=0.458, p=0.0001). A strong correlation was found between D Cobb Th and D ATR Th (r=0.6, p= 0.0001), also for D Cobb Lu and D ATR Lu (r=0.602, p= 0.0001). Weak correlations were found for D ATSI and D Cobb Th (r=0.308, p=0.01), D ATSI and D ATR Lu (r=0.296, p=0.015), and D POTSI and D ATR Lu (r=0.252, p=0.04).

Conclusion and significance

ATR seems to be a strong predictor of Cobb angle change and is proposed to be regularly evaluated to detect signs of progression or improvement. ATSI and POTSI are useful tools to detect radiological changes, especially in lumbar curves. The clinical significance of our study is that ATR, POTSI and ATSI, when combined, can ensure proper follow-up of AIS patients, helping to avoid unnecessary radiation when there are no signs of progression or to early refer for radiograph when progression is suspected.

O62

NARROWING INDICATIONS FOR BRACING IN AIS USING BRAIST-CALC

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Introduction

When BrAIST was enrolling subjects (2007-2013), AIS patients aged 10-15, Risser 0-2 with Cobb angles between 25-40 were considered to be at high risk for curve progression and therefore indicated for bracing. Reaching skeletal maturity with a Cobb angle <50 was considered to be a good prognosis as future surgery is unlikely. 48% of the untreated subjects had a good prognosis, suggesting that current indications are too broad and resulting in a high degree of overtreatment.

Objective (s)

BrAIST-Calc is a prognostic model predicting the probability that a patient will reach skeletal maturity (Risser 4+) with a Cobb angle ‹50 degrees and likely avoid surgery. The objective of this study was to use the predicted probabilities from BrAIST-Calc to define a group of patients likely to have a good prognosis who may be good candidates for observation alone.

Study Design

BrAIST-Calc was derived using prospectively-collected data and externally-validated using retrospective datasets

Methods

To evaluate the value of the BrAIST-Calc to guide the decision to brace (or not), we defined low- and high-risk groups using the distribution of predicted probabilities from untreated subjects . Since the consequences of not treating a high risk patient (undertreatment) are worse than treating a low-risk patient (overtreatment), we selected the cut-point probability associated with maximal specificity/lowest false positive rate. Assuming that patients with a predicted probability ≥ this threshold were then observed, the false positive rate is an estimate of how many patients actually had a poor prognosis and should have instead been offered bracing. The characteristics (age, Risser, Cobb) of patients in the low-risk group were summarized to provide a rough guide for the suggestion of observation alone.

Results

Predictions were available for 173 untreated subjects. The predicted probability of a good prognosis ranged from 2-98%. The model over-predicted the success rate by 6% (56% vs 50%). The c-statistic was 0.84 suggesting a high degree of discrimination. Figure 1 plots the sensitivity and specificity (y axis) by

potential probability thresholds (x axis). The specificity of 92% was associated with the cut-off probability of 0.70. At this threshold, 8% would be falsely predicted to have a good prognosis. The majority of patients with predicted probability ≥0.70 were Risser 1 or 2, with maximum Cobb angles ≤34°. 26% of 568 subjects met these criteria.

Conclusion and significance

Results from BrAIST indicate that almost 50% of the population who would typically be braced could instead be observed and still avoid surgery. Applying the 0.70 threshold probability and NOT bracing Risser 1-2 patients with Cobb angles between 25-34° would decrease the degree of overtreatment without unduly increasing the surgery rate. Patients and their families should be provided with their individualized risk estimates and the associated consequences so they can make the most appropriate decision for themselves.

O63

A METHODOLOGICAL REVIEW OF MODELS PREDICTING CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

Multiple models predicting the radiographic outcomes of bracing for patients with adolescent idiopathic scoliosis (AIS) have been published. Predictive models have the potential to inform providers and families, change their behavior and improve outcomes. Few, however, are used in clinical practice perhaps due to flawed methodology or issues with deployability. This study identified and evaluated the methodology of these models to form an overall impression of their quality and clinical utility.

Objective (s)

The purpose of this study was to identify and evaluate the methodology used to derive and validate predictive models.

Study Design

Systematic methodological review

Methods

The search included 5 electronic databases using MESH, free text terms and filters specific to prediction studies. Major search terms included adolescent idiopathic scoliosis, bracing/orthotics, and predictive model. Models derived via classic and deep learning methods were included.Two reviewers independently screened the title/abstract followed by full text screening. Demographics of the target population, and characteristics of the models (e.g. research design,predictor variables, and indicators of quality and clinical usefulness) were recorded and summarized using percentages.

Results

43 models were reviewed. There was a great deal of variability in the target populations, research design, time frame, predicted outcomes, candidate and retained model variables. 84% of the models were derived using logistic regression to predict curve progression. 9 models only included patients who were deemed highly compliant with bracing, or had progression despite bracing. The number of models meeting/reporting quality indicators such as internal or external validation, calibration and discrimination estimates and whether or not the model was deployed for clinical use (e.g. via a Web app, nomogram, or table) is given in Table 1. None reported a formal impact analysis.

Table 1. Summary of Quality and Usability Indicators

Reported using TRIPOD guidelines	1 (2)	
Representative sample	35 (81)	
Specification of full model	17 (40)	
Objective bracing compliance estimates	4 (9)	
Internal validation (reproducibility)	7 (16)	
External validation (generalizability)	2 (5)	
Performance estimates		
Calibration (plot, slope, intercept, average error)	5 (12)	
Discrimination (AUC, ROC, c-statistic)	12 (28)	
Classification (Sn, Sp, PPV, NPV, LR)	19 (44)	
Clinical deployment aid (Web app, table, nomogram)	4 (9)	

Conclusion and significance

The majority of models predicting the outcome of bracing are at a high risk of bias related to poor methodology and limited evidence of accuracy, reproducibility, generalizability or impact on clinical practice. Without specification of the entire model equation and/or a deployment aid it is very difficult to independently validate models or to use them clinically. Rather than creating new models, more resources should be devoted to deployment and impact assessment of the most promising existing ones.

O64

NORMATIVE DATA FOR RADIOGRAPHIC SAGITTAL PARAMETERS IN ASYMPTOMATIC POPULATION FROM CHILDHOOD TO ADULTHOOD: A SYSTEMATIC SEARCH AND REVIEW

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Introduction

The sagittal morphology and balance of the spine are crucial for the overall functioning of the trunk. While they are strictly linked to the risk of developing pain and, thus, disability in adulthood, they are also relevant to eventual treatments during growth. Sagittal structural alterations are present in pathological growth conditions such as scoliosis, hyperkyphosis, and junctional kyphosis and may gradually progress in adulthood. Currently, there are no defined shared normative values for the radiographic main parameters in the general population during growth (in the absence of pathological or degenerative alterations), required for a better clinical and scientific classification of the patient.

Objective (s)

The current study aims to collect reference values for radiographic sagittal measures in general population aged 0-40.

Study Design

Systematic search and review.

Methods

We conducted a systematic search of the literature published in English until July 2022 on Medline, EMBASE, CINAHL and Scopus, including all the primary studies (such as RCTs, prospective and retrospective studies, case series, and single-case studies) that reported measures of sagittal radiographic parameters in general (normal) population aged between 0-40. The frequencies of the sagittal parameters and their values have been summarized through narrative synthesis and tables.

Results

We identified 8881 articles and included 36 observational studies, considering 5006 participants, with ages ranging from 3 to 40 years. The most frequently reported measures were thoracic kyphosis (TK),

lumbar lordosis (LL), cervical lordosis (CL), pelvic tilt (PT), pelvic incidence (PI), sacral slope (SS) and sagittal vertical axis (SVA). We found a mean TK of 41.8$\pm$9.5 (18 studies), LL of 49.9$\pm$10.1 (17 studies), CL of 4.2$\pm$10 (5 studies), PT of 10.3$\pm$7.3 (24 studies), PI of 48.7$\pm$10.4 (24 studies), SS of 38.8$\pm$7.8 (20 studies) and 9.7$\pm$25.8 (17 studies). All parameters increased with age but at a different rate, reaching the adult norm at different ages.

Conclusion and significance

Normative data from the general population can be useful for clinicians to classify patients with spine sagittal alterations and better personalize the interventions. In clinical practice, it is important to know the reference values by age to propose appropriate treatments. Even though there is a lot of research in the field, data during growth are still scarce and the current evidence does not allow a complete synthesis of the data, due to a significant heterogeneity in the studied population and reporting.

O65

DISTRIBUTION OF CURVE FLEXIBILITY IN IDIOPATHIC SCOLIOSIS - A DESCRIPTIVE STUDY

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Introduction

Curve flexibility is an important variable for adolescent idiopathic scoliosis (AIS) outcomes. This study sought to determine the distribution of flexibility in a multicenter AIS cohort and investigate associated characteristics.

Objective (s)

It was hypothesized that flexibility would be normally distributed and would correlate with a number of patient characteristics such as BMI and skeletal maturity.

Study Design

This study was a multicenter retrospective cohort study.

Methods

AIS patients who received surgical treatment at a Harms Study Group (HSG) center were included. Flexibility was measured using lateral bending radiographs. The distribution was graphed using SPSS, and the relationship between flexibility and other parameters was assessed using t- and chi square tests. Pearson's R was used for regression analysis. Means and standard deviations are reported where appropriate.

Results

4,574 patients (mean age: 14.5±2.2 years, 80.5% Female) were included. The mean flexibility was 72.0±11.6%. Both primary thoracic (Lenke 1+2, N=2895) and primary lumbar curves (Lenke 5+6, N=1030) followed a bell-curve. The mean thoracic curve flexibility was 71.4±11.7%. The mean primary lumbar curve flexibility was 68.9±12.1%. Higher age was inversely correlated with flexibility (p=0.002). Interestingly, better SRS22 and SRS24 scores were associated with lower flexibility (p<0.03, p<0.01). Patients who were a healthy weight had more flexible curves than those who were overweight (p = 0.019). Skeletally immature patients had more flexible curves than those who were skeletally mature (p=0.003). Not associated with curve flexibility were sex (p=0.124), weight (p=0.536), and height (p=0.121). Thoracic curves were more flexible than lumbar curves (p<0.001). Increased BMI was associated with decreased flexibility in thoracic curves (p<0.001), but not with lumbar curves (p=0.963). Additionally for thoracic curves, those with a lumbar A modifier were significantly more flexible than B

(p<0.001) and C (p<0.001) types. For sagittal parameters, normo-kyphotic and hypo-kyphotic curves were more flexible than hyperkyphotic curves (p=0.001).

Conclusion and significance

Flexibility follows a bell-shape in AIS patients. Thoracic curves were more flexible than lumbar curves, and only thoracic curves vary with BMI. Additionally, higher SRS scores were tied with less flexible curves. Finally, skeletally immature curves were more flexible than skeletally mature curves.

This study describes the distribution of flexibility in a large population of AIS patients. It also examines previously described relationships between flexibility and various patient characteristics with a significantly larger sample size than previous studies, as well as describing several new factors that correlate with curve flexibility.

O66

COMPARISON OF THE KEY RADIOLOGICAL CRITERIA WITH SURFACE TOPOGRAPHIC CRITERIA IN THE RIGO CLASSIFICATION

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Introduction

The Rigo classification system (RCS) utilizes various radiological criteria to classify adolescent idiopathic scoliosis (AIS) using 4 main types (A, B, C, E). However, no descriptive data for the criteria has been reported beyond the curve pattern. Doing so, with radiography in addition to surface topography (ST), would allow exploration and improvement of these criteria.

Objective (s)

1) To quantify the criteria of the RCS based upon X-ray and ST. 2) To compare differences in key criteria of the RCS between X-ray-based and ST-based measurements. 3) To determine the correlation between X-ray-based and ST-based measurements.

Study Design

A retrospective analysis was performed in which one observer measured key criteria of the RCS on both ST and X-ray images.

Methods

Four observers classified ST and X-ray AIS images according to the RCS. One observer then measured the following RCS criteria for ST and X-ray (PACS IntelliSpace Radiology System) in the PA view, twice for each image and averaged the measurements: T1 offset, T1 tilt, transition point (TP) offset, L3 tilt, L4 tilt, L5 tilt, and pelvic shift. T1 and TP offset were defined as the distance from the central sacral line (CSL). Tilt was defined as the vertebral body angle from the horizontal line. Pelvic shift was defined as the difference between the horizontal distances from T1 to the most lateral edges of the iliac crests, or that of the acetabula if the iliac crests were not visible. Descriptive analysis (mean and ± standard deviation), paired t-test, and Pearson correlation were performed (R version 4.3.1). $P<0.05$ was considered significant.

Results

Images were selected for 31 children with AIS (23 females, 8 males), ranging from 13-18 years old (average 13.5 years old). Between ST and X-ray, the TP offset showed no significant differences ($P>0.05$) and strong correlation ($r=0.90$, $P<0.0001$), and had the following average type values for ST and X-ray, respectively: A: 18.83, 16.57; B: -8.86, -10.55; C: 0.67, 2.68; E: -17.44, -24.22 (mm). T1 offset and pelvic

shift had no significant differences between ST and X-ray (P>0.05) and had moderate correlation (r=0.59 to 0.73, P<0.001). All other criteria were significantly correlated between ST and X-ray (r =0.76 to 0.90, P<0.05), except for T1 tilt. Significant differences existed between ST and X-ray for the following criteria and types: T1 tilt (B, C); L3 tilt (B, E); L4 tilt (A, B); L5 tilt (A).

Conclusion and significance

Both ST and X-ray provide a valuable range of key criteria of the RCS. ST-based TP offset, T1 offset, and pelvic shift play a similar role as X-ray-based criteria in the determination of RCS curve type, and may be considered an important alternative to radiological criteria for the RCS.

O67

INTER-RATER AND INTRA-RATER RELIABILITY OF A NEW ADOLESCENT IDIOPATHIC SCOLIOSIS CURVE TYPE CLASSIFICATION, BASED ON CLINICAL, RADIOLOGICAL, AND PROGNOSTIC CRITERIA

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Introduction

Physiotherapeutic Scoliosis Specific Exercises (PSSE) are curve-pattern specific, so each School follows a curve type classification to predefine some corrective strategies to be implemented during the exercises. PSSE-Schroth method introduced an innovative classification system based on clinical, radiological, and prognostic criteria. It is the first PSSE method, using a system for deciding when and how much overcorrection of the main curve is needed, giving the therapist the opportunity to know from the initial classification how to accordingly treat their patients.

Objective (s)

Our aim was to evaluate the inter-rater and intra-rater reliability, with test-retest assessment, of PSSE-Schroth method curve type classification.
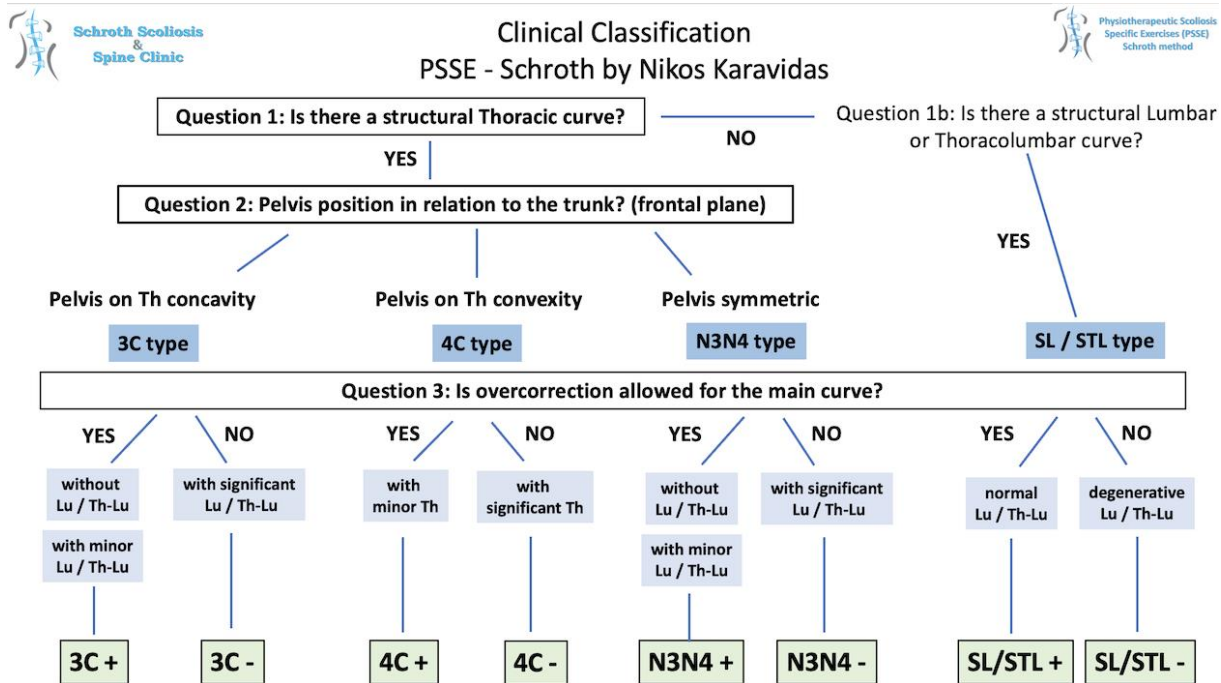
Study Design

Reliability study

Methods

PSSE-Schroth classification describes 8 categories of curve types (3C+, 3C-, 4C+, 4C-, N3N4+, N3N4-, STL/SL+, STL/SL-), which are classified following a specific algorithm, by answering only three simple questions. The signs +/- describe if over-corrective exercises are allowed for the main curve. STL/SL- is only for adult degenerative scoliosis, so it was excluded for the purpose of this study, therefore totally 7 curve types were analyzed. We used a sample of 45 random patients (mean age 13.3 years, Cobb angle thoracic 33.6º and lumbar 32.9º, angle trunk rotation thoracic 9.6º and lumbar 7.3º), that were assessed by 4 blinded raters, already certified in PSSE-Schroth method.

The raters received an anterior-posterior radiograph, clinical photos in standing and forward bending position, both in ventral and dorsal aspect. Based on our algorithm, they independently classified our subjects as first round. One week later, they repeated the measurements, but having also scoliometer values for thoracic and lumbar curves. Percent Agreement for More Than Two Raters was used for statistical analysis, taking the mean level of agreement across all pairs of coders.
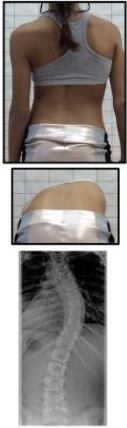

Results

The mean inter-rater percent agreement for the first round was 0.82 (between 0.73 and 0.89), while the retest inter-rater agreement for the second round was 0.87 (between 0.84 and 0.93). The mean intra-rater agreement for test-retest with scoliometer values was 0.95 (between 0.89 and 1.00). In 35/45 (77.8%) of subjects there was absolute 100% agreement between raters.
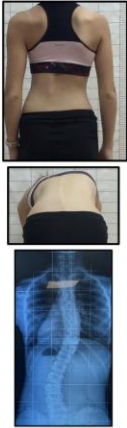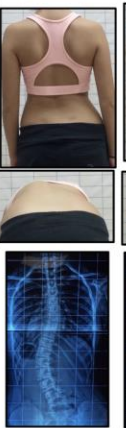
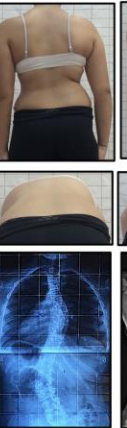**PSSE-SCHROTH CLASSIFICATION** — Physiotherapeutic Scoliosis Specific Exercises (PSSE) Schroth method — BY NIKOS KARAVIDAS (2022)

Conclusion and significance

PSSE-Schroth classification showed a very good inter-rater percent agreement of 0.87 and an excellent intra-rater percent agreement of 0.95. It is a very analytical and precise classification system including 8 different curve types and proved to have very good to excellent reliability. Therefore, PSSE-Schroth classification can be recommended for effective use in AIS curve type classification and treatment.

O68

DEVELOPMENT AND VALIDATION OF DEEP LEARNING ALGORITHMS FOR SCOLIOSIS SCREENING USING BACK IMAGES

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Introduction

Application of deep learning algorithms (DLAs) may potentially resolve the long-term debatable questions of unnecessary referral and excessive cost in school scoliosis screening (SSS).

Objective (s)

To develop and validate deep learning algorithms (DLAs) for the automated screening of scoliosis using bare back images.

Study Design

This is an original research article.

Methods

A training data set consisting of 3,240 back images was labeled and classified based on curvature severity according to whole-spine standing posterior-anterior radiographs or ultrasound images. A faster region-based convolutional neural network (Faster-RCNN) was used to localize individuals' backs. A deep residual convolutional neural network (Resnet) was deployed to train the algorithms to identify scoliosis with different severities. The resultant algorithms were tested using internal and external validation. Five-fold cross validation was adopted to evaluate the performance of the algorithm.The main outcome measures were the area under the receiver operating characteristic curve (AUC), sensitivity and specificity of the trained DLAs for detecting scoliosis (Cobb angle ≥ 10º) and cases with curves ≥ 20º. The performance of the expert panel (1 senior spine specialist and 2 junior spine surgeons) was considered as a reference standard.

Results

In the internal validation, the AUC of the DLAs for detecting scoliosis and cases with curves ≥20° were 0.946 (95% Confidence Interval (CI), 0.916 - 0.975) and 0.951 (95% CI, 0.933 - 0.970), respectively. The average accuracies of these two algorithms were outperforms the level of human experts (DLAs : Human = 85.6% : 67.8% for algorithm 1, DLAs : Human = 87.6% : 79.6% for algorithm 2) . In the external validation, the AUCs of DLAs for detecting scoliosis and cases with curves ≥ 20° were 0.811 and 0.929, respectively. The results showed that DLAs had a comparable level of accuracy with human specialists

(DLAs : Human = 75% : 72.4%) for detecting scoliosis, while for detecting cases with curves ≥ 20°, the accuracy of DLAs was superior to the human expert panel (DLAs : Human = 87% : 81.9%).

Conclusion and significance

We successfully developed and trained DLAs to detect scoliosis and curves ≥ 20° , which were comparable to that of human experts without time constraints. Our approach can be potentially applied in a routine scoliosis screening workflow and for periodic follow-ups of pre-treatment cases without radiation exposure.

O69

ADVANCED 3D TORSO SCAN ANALYSIS FOR COBB ANGLE PREDICTION IN AIS: REGRESSION-FOCUSED CNN WITH REPEATED STRATIFIED CROSS-VALIDATION.

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Introduction

Adolescent Idiopathic Scoliosis (AIS) constitutes 80% of structural scoliosis cases, with X-ray reliance in scoliosis management posing a cancer risk later in life. Our team has developed a novel markerless surface topography (ST) method, combined with advanced artificial intelligence (AI) techniques, particularly convolutional neural networks (CNNs), to analyze trunk ST images.

Objective (s)

This study aims to employ CNNs for accurately predicting the maximum Cobb angle in AIS patients using non-invasive ST scans.

Study Design

This cross-sectional study uses 3D torso scanning technology and a regression-based CNN model for predicting the Cobb Angle in AIS patients.

Methods

We analyzed ST scans from 233 AIS patients using high-resolution scanners and augmented by 190 follow-up scans, alongside 242 lower resolution scans using an iPad-mounted Structure Sensor. This resulted in a comprehensive dataset of 665 scans . Patients aged 10-18 years were included with Cobb angles ranging from 10° to 97°. We excluded angles from 60° to 90° for statistical robustness, resulting in 654 subjects. A 10-fold cross-validation method, repeated 10 times per CNN model, led to 100 unique models. Stratified cross-validation was used to ensure Cobb Angle ranges were fully represented during the training process. This robust process, combined with dynamic data augmentation, aimed to create a CNN model for accurate interpretation of scoliotic topography and max Cobb angle prediction. These models are averaged to perform predictions on the whole training set and testing set.

Results

The model consistently demonstrated a Mean Absolute Error (MAE) between 4.84° and 4.98° across multiple iterations of the cross-validation process, highlighting its precision and reliability in performance. The CNN model demonstrated a high correlation in predicting Cobb angle with R=0.96 and R2=93 on the training set, and R=0.75, R2=0.56 on the testing set. An average mean absolute error (MAE) of 6.35° was observed when predicting unseen data.

Conclusion and significance

Our CNN model, utilizing ST and a cross-validation approach, shows promising results in predicting AIS max Cobb angle. This method could potentially reduce the reliance on X-rays in scoliosis monitoring, offering a non-invasive and accurate alternative for clinicians.

O70

COMPARISONS OF INTER-APICAL DISTANCE AND CORONAL BALANCE AMONG STANDING POSITIONS IN HEALTHY PARTICIPANTS AND ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS USING 3D ULTRASOUND IMAGING

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Introduction

Apical vertebral translation (AVT) is an indicator of clinical symptoms and treatment outcomes in those with adolescent idiopathic scoliosis (AIS). AVT refers to the lateral deviation of an apical vertebral body relative to the central sacral vertebral line (CSVL). Stereo-radiography simultaneously captures a frontal and lateral image, yet patients are required to elevate their arms during the examination. Exposing the hands above the shoulders may allow assessing skeletal maturity. However, varied positioning may impact coronal plane measurements. Ultrasound (US) imaging can assess AVT in different positions without exposing participants to the harmful effects of radiation.

Objective (s)

This study aimed to quantify whether inter-apical distance and coronal balance measured on 3DUS images differed between ten standing positions in females with and without AIS.

Study Design

Cross-sectional study comparing coronal plane measurements between ten standing positions.

Methods

Fifty-nine female volunteers with and without AIS were recruited from emailed advertisements and a scoliosis clinic, respectively. Participants underwent 3DUS scans in ten different arm positions: habitual standing; arms supported anteriorly at 60° of flexion; fingers to clavicle, chin, cheeks, and eyebrows; arms abducted at 90°; hands on wall, on blocks; and hands unsupported. Inter-apical distance and coronal balance measurements were obtained by one novice evaluator using custom software after a demonstration, and measuring six practice cases on two occasions. AVT measures the horizontal distance from the centre of the lamina for each apex to the CSVL. Inter-apical distance is the difference between the most deviated apices to the right and to the left. The measurements have demonstrated excellent intra- and inter-rater reliability ($ICC_{2,1}$=1.00). Measurements from different positions were compared between healthy, single, and double curve groups using mixed-effect model ANOVAs with Sidak pairwise comparisons.

Results

Abstracts

Participants had a mean age of 17.5±4.9 years, a height of 162.8±5.8cm, and a weight of 56.2±10.6kg. Fourteen AIS participants had single curves and seventeen had double curves with mean maximum curve angles of 26.4°±3.6° and 25.2°±3.1°, respectively. There were no significant interactions between groups and positions for both inter-apical distances and coronal balance. There were no statistically significant differences in inter-apical distance or coronal balance between the ten positions (p>0.05). Inter-apical distances were significantly larger in the single and double curve groups than in the healthy group but did not differ between curve types (Figure). Coronal balance did not differ significantly between groups for any position (Figure). The largest inter-apical and coronal distance differences observed between groups were 21.8 and 5.4mm, respectively.

Conclusion and significance

The ten positions evaluated may be interchangeable for inter-apical distance and coronal balance measurements of female AIS participants. This finding offers promise for monitoring AIS progression and may help treatment planning, as scans can be meaningfully compared over time for these measurements despite potential differences in positioning.

O71

THE EFFECT OF ARM POSITIONS USED DURING RADIOGRAPHY ON SPINAL ALIGNMENT PARAMETERS ASSESSED BY 3D ULTRASOUND IMAGING IN ADOLESCENTS WITH AND WITHOUT IDIOPATHIC SCOLIOSIS WITH TWO DIFFERENT CURVE TYPES

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Introduction

Clinicians monitor scoliosis progression using multiple radiographs during growth. During low-dose stereo-radiographic imaging, the arms must be elevated to visualize all vertebrae, possibly affecting sagittal spinal parameters. It is unclear which arm positions lead to sagittal measurements that are most representative of the habitual posture and whether such positions could simultaneously allow for the scoring of digital skeletal maturity.

Objective (s)

This study aimed to determine the arm position, using frontal, sagittal, and transverse angles measured using 3D ultrasound imaging, that best represents habitual standing (as well as allowing hand-based skeletal maturity assessment) that could be used during simultaneous frontal and lateral radiographs.

Study Design

Cross-sectional study comparing spinal alignment between ten standing imaging positions.

Methods

Females with and without AIS, as well as males with AIS were recruited consecutively from emailed ads, our scoliosis clinic and letters to patients having consulted community physicians for scoliosis. Using 3D Ultrasound imaging (3DUS), patients were scanned in 10 arm positions; habitual standing, arms supported anteriorly at 60° flexion, fingers to clavicle, chin, cheeks, and eyebrows, arms abducted 90°, hands on wall, on blocks, and hands unsupported. Axial vertebral rotation (AVR) differences, frontal, and sagittal curve angles were measured using custom software. Repeated measures ANOVAs with Sidak post-hoc tests compared positions.

Results

Ninety females with and without AIS had mean age, height, and weight of 17±4years, 162±6cm, and 55±10kg, respectively. Among females with AIS, 30 had a single curve and 30 had a double curve. Ten

males with AIS with mean age height, and weight of 16±3years, 174±11 cm, and 63±13 kg, respectively, were also included.

Females with single AIS curve showed significantly larger curves in standing in all positions excluding hands on blocks (mean difference (MD) range 4.2-8.3º) (Figure 1). Sagittal parameters showed significant decreases in kyphosis in arms abducted 90º (3.3º) and increases in lordosis in fingers to cheeks/eyebrows (9.0º/5.8º) compared to habitual standing. AVR twist was not significantly affected by change in position. Male AIS showed comparable results to females (Max curve angle 3.0-7.1º, Whole kyphosis 0.5-18.1º, T4/T5 Kyphosis 1-10.2º, Lordosis 0.7-7.7º, AVR twist 0.1-1.6º), but no significant differences were detected among positions.

Mean Maximum Curve Angle

Conclusion and significance

There is not one position that represents habitual standing for all groups. When arms are raised, decreases in max curve angle were shown in single-curve patients, and similarly, decreases in kyphosis and increases in lordosis for all groups. Most accurate positioning for all parameters is demonstrated in fingers to chin position. Hands on wall is most accurate for a position that exposes the hands for maturity assessment. Given the differences observed among positions, standardization over time and between centers appears essential.

O72

USING B-MODE ULTRASOUND TO EVALUATE THE RISSER GRADE FOR DETERMINING SKELETAL MATURITY IN FEMALE ADOLESCENTS

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Introduction

Adolescence is a period marked by rapid physical changes, including an increase in height, alterations in body composition and the emergence of secondary sexual characteristics. This pubertal growth period is associated with an increased vulnerability/risk of disease and disease progression (e.g. mental health issues, epilepsy, scoliosis, pain syndromes, type 1 diabetes onset). It is a critical time for the implementation of interventions and treatments for adolescents with developmental conditions such as adolescent idiopathic scoliosis (AIS). Using a non-ionising imaging technique, such as B-mode ultrasound, may enable more frequent assessment of skeletal maturity.

Objective (s)

To determine the *inter-rater* reliability, and *concurrent* and *face* validity of using B-mode ultrasound to assess skeletal maturity (Risser Grade) and provide procedural guidelines to facilitate utility of this method.

Study Design

Data originates from the case-control Back-in-Action study, collected from April-2022, to September-2023.

Methods

23 female adolescents with a primary-right-thoracic AIS [Cobb: 38(14.3)°; age: 13.8(1.6) years] and 20 age-matched female control participants without scoliosis [age: 13.2(1.8) years]were recruited. Control participants were screened for (absence of) scoliosis using a scoliometer.

Skeletal maturity was determined from (i) a series of nine B-mode ultrasound images collected at sites equally spaced between the anterior and posterior superior iliac spines of the pelvis and (ii) for AIS participants only, clinical spine radiographs including the pelvis obtained as part of standard care (Fig.1 top panel). Images were scored according to the degree of iliac apophysis growth and fusion (Fig.1 left panel). *Inter-rater reliability* was assessed between a novice researcher and an experienced medical doctor. *Concurrent-validity* was assessed by comparing the location and degree of apophysis growth and

fusion obtained via ultrasound, with that obtained using radiograph Risser grading for AIS participants only. *Face-validity* was assessed against date of menarche, and participant age.

Figure 1. Participant position, radiograph, and ultrasound images

Top panel: (A) Participant in a lateral lying position with their left hip facing superiorly. (B) Radiograph depicting the nine recording locations from the anterior superior iliac spine (ASIS), to 9: posterior superior iliac spine (PSIS), with blue triangles at 0%, 25%, 50%, 75% and 100% of the iliac crest. (C-D) Surface representations of these positions were drawn on the skin to facilitate accurate positioning of the ultrasound head.

Left panel: Example, ultrasound images of the iliac crest: (I) no apophysis, (II) unfused apophysis and (III) fused apophysis.

Results

The *inter-rater reliability* of ultrasound Risser grading was strong [ICC(2,1): 0.99]. High *concurrent* and *face-validity* was determined, with no difference in Risser grading identified between the radiograph and ultrasound grading methods (Wilcoxon signed-rank: Z = -1.93, p =0.053), and a multivariant analysis found very high-positive correlations between ultrasound Risser grade, and both chronological age and menarche onset (r= 0.81, R^2=0.65, *p*<0.001).

Conclusion and significance

Ultrasound provides a reliable non-ionising alternative to the gold standard of Risser grading from radiographs to determine and monitor skeletal maturity. This study provides detailed methodology for using ultrasound to assess skeletal maturity.

O73

THE USE OF ULTRASONOGRAPHY TO MEASURE THE FLEXIBILITY OF SCOLIOSIS IN CORONAL BENDING

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Introduction

The treatment of idiopathic scoliosis depends on many factors. The curvature flexibility is one of them. Currently, it is assessed with coronal bending radiographs.

Objective (s)

The aim of the study was to evaluate the application of ultrasound examination to measure the curvature flexibility in patients with idiopathic scoliosis.

Study Design

Prospective diagnostic trials

Methods

The study included 40 patients admitted for surgical treatment due to idiopathic scoliosis, aged 14.1±2.0 years. A standing antero-posterior radiological and ultrasound examinations of the spine were performed, as well as a radiological and ultrasound examination of coronal bending. The radiological assessment consisted of measuring the Cobb angle, while the ultrasound assessment evaluated the course of the spinous process line in accordance with the methodology described for the device. The curvature flexibility was defined as the difference between the curvature angle in the standing position and the angle in lateral bending presented as degrees and as percentages.

Results

The Cobb angle was 55.6o±17.2o in the thoracic and 48.0o±13.9 in the lumbar spine.

The ultrasound angle was 35.5o±12.5o in the thoracic and 31.0o±10.6o in the lumbar spine

The Cobb angle showed a significant correlation with the ultrasound angle: thoracic spine R=0.82, p<0.001; lumbar spine R=0.70, p<0.001.

There was no difference in curvature flexibility in degrees between radiological and ultrasound measurements at the thoracic level (20.9o±10.9o vs. 17.4o±13.6o, p=0.15). The flexibility in degrees differed significantly at the lumbar level (27.7o±10.2o vs. 19.1o±19.1o, p=0.015).

The curvature flexibility in percentage differed at the thoracic level (39.2% ± 20.2% vs. 58.0% ± 32.7%, p=0.013). However, there was no difference in the lumbar level (61.5% ± 23.4% vs. 70.1% ± 89.2%, p=0.221).

Conclusion and significance

It is possible to assess the bending correction of idiopathic scoliosis using ultrasound examination. In the thoracic spine the curvature flexibility in degrees does not differ between ultrasound and radiological assessment.

O74

IDENTIFYING PREDICTORS OF BRACE TREATMENT OUTCOMES USING ARTIFICIAL INTELLIGENCE IN CHILDREN WITH IDIOPATHIC SCOLIOSIS

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Introduction

Bracing is an effective conservative treatment for adolescent idiopathic scoliosis (AIS). It is not clear which candidates would benefit from bracing the most. Currently, prediction models available for prediction of the brace success or failure for AIS still lack accuracy.

Objective (s)

This study aimed to identify parameters to predict curve severity outcomes during brace treatment using artificial intelligence for children with idiopathic scoliosis.

Study Design

Retrospective cohort.

Methods

Eighty-one participants with AIS were included (74F, 7M, aged 12.6±1.3 yrs). All participants received rigid brace treatment. The mean±SD of the major Cobb angle was 33.5°±7.6° (10° to 49°). The average time interval between the initial and the last out-of-brace visit was 16.9±8.6 months. Candidate predictors collected at the initial visit included: major Cobb angle, maximum axial vertebral rotation (max AVR) [measured using the Stokes method comparing AVR at, above and below the apex], in-brace AVR correction, in-brace Cobb angle correction, Risser sign, Schroth curve classification, curve direction, age, sex, number of curves, and number of vertebrae within the main curve.

The dataset was randomly distributed into 80% and 20% for model training and testing, respectively. Three common machine learning algorithms i) random forest, ii) support vector machine (SVM), and iii) GXBoost were investigated. A correlated heat map was first performed to eliminate the highly correlated parameters. A 5-fold cross validation was then applied during feature selection to identify selected predictors. The outcome predicted was dichotomized treatment success (no curve progression >5°). We also tested prediction of curve angle change as a continuous variable between baseline and a follow-up at 16.9±8.6 months.

Results

Twelve cases had curve progression >5° and 69 did not. The accuracy of the models predicting dichotomized prediction of progression for the random forest, SVM methods, and GXBoost, respectively, were 76%, 35% and 47%. To predict the curve angle changes (-3°±10°), the accuracy dropped to 53%, 35% and 41% for each method, respectively, and the error was approximately 10°. The two most important predictors for random forest predicting dichotomized curve progression were the major Cobb angle and Schroth curve classification. The important predictors also using random forest for predicting curve angle changes were in-brace correction, max AVR, curve classification, curve direction and Risser sign, respectively.

Conclusion and significance

Overall, the accuracy of predictions was better for predictions of dichotomized outcome than for curve progression change particularly for the model developed using random forest method. Although the random forest algorithm showed a moderate accuracy of 76% for predicting success, the model still needs refinement for clinical use. More clinical data is needed, (especially more progressive cases) to improve prediction accuracy. Identifying predictors of treatment success could help orthotists to plan treatment strategies.

O75

HIGHER RIGO-CHENEAU WEAR-TIME IS ASSOCIATED WITH CURVE REDUCTION AND LOW RISK OF PROGRESSION TO SURGERY

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Introduction

Idiopathic scoliosis (IS) is a 3-dimensional (3D) spinal deformity with no identifiable underlying cause. Bracing is the mainstay conservative treatment to delay curve progression through non-invasive means with past studies showing overwhelmingly positive results. This study adds to the wealth of literature emphasizing the importance of wear-time on scoliosis bracing.

Objective (s)

The purpose of this study is to investigate the impact of Rigo-Cheneau bracing in the idiopathic scoliosis population.

Study Design

Single-center retrospective cohort

Methods

IS patients undergoing bracing treatment with a compliance monitor at a single institution were identified. Patients with curves between 15-50°, no prior interventions, and charted two-year follow ups were included. This sample totaled 153 patients. After excluding patients with incomplete wear-time data (due to sensor malfunction, loss of sensor, etc.), 46 braced subjects with complete 2-year wear-time data were identified. 10 patients that progressed to surgery before capturing 2-year wear-time data were also included.

"Success" was defined as progression <6° and no surgery performed. Means along with standard deviations are reported. T-tests were used to analyze the differences in major curve at study time points and to make comparisons between groups.

Results

The population (86% female) had a mean age at brace initiation of 10.4 ± 2.2 years. Subjects were followed for an average of 2.9 ± 0.9 years. 13 patients failed treatment including the 10 patients progressing to surgery. For subjects who failed treatment, the average pre-brace curve size was 33° ± 8° which progressed to 50° ± 9° at most recent follow-up (M=17°, *p<0.001*). For the treatment success cohort, the average pre-brace curve of 28° ± 7° decreased to an average of 20° ± 9° (M=-7°, *p<0.001*). The average pre-brace curve was larger in the failure cohort (33° vs. 28°, *p=0.065*). Subjects

failing treatment had a significantly lower average wear-time when compared to the successful subjects (6.3 ± 3.1 hours vs. 11.1 ± 4.1 hours, *p=0.003*).

Conclusion and significance

This preliminary study serves as further evidence in support of bracing in halting progression, and in many cases decreasing curve magnitude, in a limited cohort of IS patients treated with a Rigo-Cheneau style brace at a single center. Furthermore, higher brace wear-time was shown to be associated with treatment success.

This study can be used as a pilot for future studies assessing outcomes of bracing in patients with IS. Future directions include examining the optimal daily brace prescription to balance treatment efficacy and patient quality of life in this cohort with comprehensive wear-time data. A multicenter prospective study assessing 3D correction with bracing and compliance data is currently ongoing and our site is initiating a prospective study analyzing the efficacy of part-time bracing in mild JIS curves.

O76

EFFECTIVENESS OF SCHROTH PHYSICAL THERAPY PROGRAM ON CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) WITH VARYING BRACE INTERVENTIONS- A RETROSPECTIVE STUDY

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Introduction

Adolescent idiopathic scoliosis (AIS) is a common spinal deformity in children whose management depends on the curve magnitude and the child's skeletal maturity. Children often undergo bracing with or without physiotherapy scoliosis-specific exercises (PSSE) to prevent curve progression. Although bracing has proven effective to reduce progression of curve magnitude, there continues to be inconsistencies on the style of brace that is often recommended. It has not been established if with consistent PSSE exercises, if a difference in progression of curve magnitude can be noted between nocturnal and full time brace wear.

Objective (s)

Can PSSE physical therapy added to bracing protocol improve Cobb angle in patient's with adolescent idiopathic scoliosis?

Study Design

Single center, retrospective evaluation of AIS patients treated between 2020-2023 with Schroth PT patients who utilize nocturnal or full time bracing.

Methods

Inclusion criteria for the study is children 10-18 years, primary curves 20-40 degrees, Risser 0-3, follow up >6 months and attendance of Schroth PT sessions > 3 times. Exclusion criteria was age <10 years or >18 years, Risser >4, non-idiopathic scoliosis diagnosis, Cobb </=19 degrees or >/=41 degrees, follow up <6 months, patients with documented cognitive or developmental delay, prior surgical spinal intervention, no brace recommended or attended 2 or fewer Schroth PT sessions. Outcomes include curve magnitude at final follow-up, brace compliance, percentage of curve correction achieved within their nocturnal brace, follow-up period, patient demographics and number of patients meeting surgical criteria at conclusion of follow-up.

Results

No significant differences were noted between the groups in terms of age, gender, BMI, bone age (Risser and Sanders), initial curve magnitude or percentage of in-brace correction.

	FTBPT (n=26)	NTBPT (n=24)	p-value	95% Confidence Interval
Initial Cobb	31.46°	30.67°	P = 0.5610	-3.6804 to 2.0204
Concluding Cobb	33.15°	36.167°	P = 0.4848	-4.9485 to 10.2819
Brace Compliance	14.97 hours (n=26)	7.156 hours (n=23)	p=0.000	95% Median CI (8.544, 12.1) (7.71, 8.15)
%IBC	42.2%	58.3%	p=0.069	95% Median CI 0.186, 0.600) (0.446, 0.671)
Follow-Up Period	20.85 months	14.2 months	p= 0.007	(17, 24) (10.480, 17.35)
Schroth PT Sessions	10.65 sessions	11.4 sessions	p=0.609	(8.97034, 12) (9,12.8019)
Outcome within Group	P=.46	P=.03		

Adolescents who were in full-time bracing and Schroth PT exercises had a longer duration of follow-up, were found to be more compliant with their bracing and showed less progression overall (35.4% improved as well as progressed with FTB vs 12.5% improving and 45.8% progressing with NTB) compared to those with nocturnal bracing and Schroth PT. Similar percentages progressed to surgical threshold (23% vs 20.8%) and underwent surgical fusion (7.7% and 8.3%).

Conclusion and significance

Full time brace wear in combination with PSSE intervention appears to be more effective to improve AIS curve magnitude, compared to nocturnal brace wear with PSSE intervention.

O77

DEVELOPMENT OF A VISUO-PROPRIOCEPTIVE STIMULATION DEVICE FOR ADOLESCENT IDIOPATHIC SCOLIOSIS REHABILITATION: RESEARCH PROTOCOL

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Introduction

Idiopathic scoliosis (IS) is often associated with deficits in trunk sensorimotor control. Muscle vibration (MV) and virtual reality (VR) can be used to modify user behaviour through respectively inducing illusions of movement and embodiment. These two stimulations have a great potential in rehabilitation of sensorimotor disabilities.

Objective (s)

The aim of this study is to quantify the effects of MV and VR on trunk perception and actual movement on individuals with and without IS, to further develop a stimulation system that could facilitate trunk correction in adolescents with IS. Our hypothesis is that MV and VR can induce perceptual and postural responses on individuals with and without IS when applied separately and larger responses when applied in combination.

Study Design

We are conducting a cross-sectional study involving 45 participants divided into three groups: 15 young adults (18 –35 years), 15 adolescents with IS (15-45º) having right thoracic curvature (Lenke 1) or right thoracolumbar curvature (Lenke 5) and 15 adolescents without IS, both latter groups aged 11 –17 years.

Methods

In the adolescent groups, MV and VR will be applied separately and in combination during sitting, standing positions and walking. MV involves the application of vibrators on abdominal and spinal muscles, while VR involves the modulation of the posture of the participants' self-avatar towards the trunk self-correction movement exercises practised in scoliosis-specific physiotherapy. Perceptual and postural responses of the trunk induced by MV and VR will be evaluated using respectively a numerical scale (0-10) and a VICON system with markers placed on the head, trunk, pelvis, and lower limbs. Descriptive statistics will be used to describe trunk perception and actual movements induced by VM and VR. Correlations between these two outcomes will also be assessed.

Results

Data collected from the adult group showed that MV of the trunk induced perception of trunk movement, with respective average scores in sitting and standing positions of 5.1±1.7 and 5.1±1.9/10 on the scale mentioned above. Perception was predominantly directed (56%) towards the direction of the stimulated muscle concentric contraction, i.e., flexion (for bilateral abdominal muscle vibration), extension (bilateral spinal muscles), left (left trunk muscles) and right-side (right trunk muscles) bending in both positions. Directions of actual trunk movements were similar to perceived movements, with average displacements respectively in sitting and standing positions of 3.5±3.8°; 4.9±4.2° in flexion, 1±3.8°; 4.9±4.2° in extension, 2±2.8°; 2.7±2.9° in left side bending and 2.2±3°; 3.2±3.8° in right side bending. Trunk displacement and the score of perception were moderately correlated in sitting and standing positions (Pearson's correlation: r=0.39 and r=0.44, p<0.001, respectively).

Conclusion and significance

These preliminary results confirm that MV can temporarily modify trunk posture in young adults without IS, which warrants its evaluation on adolescents with and without IS.

O78

PHYSIOTHERAPY SCOLIOSIS SPECIFIC EXERCISE IMPROVES TRUNCAL SHIFT IN IDIOPATHIC SCOLIOSIS - A COMPLIANCE FOLLOW-UP

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Introduction

Truncal shift, measured by the Maximal Thoracic Apical Deviation (MTAD) measurement, in patients with Idiopathic scoliosis (IS), has shown to improve following an intensive course of Physiotherapy Scoliosis Specific Exercise (PSSE), with results maintained at 2-year follow-up. However, it is unknown how compliance to a prescribed home exercise plan influences the maintenance of MTAD improvements at follow-up.

Objective (s)

To determine whether the degree of compliance to a home exercise programme had an impact on MTAD at follow-up.

Study Design

Retrospective cohort design.

Methods

Consecutive IS patients with a right thoracic curvature who completed a 4-week PSSE programme were recruited. MTAD to the right (MTADr) measurements were collected from patients who were routinely scanned using a Formetric Scanner pre-, post-, 12- and 24-months post-treatment. Compliance was self-reported during each check-up appointment attended and grouped in to none-, low-, moderate- or high-compliance. Descriptive statistics were used to analyse the results.

Results

53 participants were included with an average age of 28 (range=12-81). 91% were female. At 12 months, out of a total of 51 patients, 7.8% were non-compliant, 31.3% had low-, 33.3% had moderate- and 27.5% had high-compliance. At 24 months, out of a total of 35 patients, 20% were non-compliant, 42.8% had low-, 22.8% had moderate- and 14.2% had high-compliance. There was a weak positive correlation between compliance and apical deviation at 12- (r=0.26) and 24-months (r=0.23) post-treatment.

Conclusion and significance

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Home exercise compliance reduced over time and does not appear to be a significant factor in sustaining improvements in MTADr obtained following an intensive course of PSSE. If the sole goal of therapy is to maintain MTADr in IS patients, then home exercise compliance does not appear important, however it is not known whether the other additional benefits of PSSE are influenced by home exercise compliance.

O79

MILD AND MODERATE ADOLESCENT IDIOPATHIC SCOLIOSIS: RIGO CONCEPT INTERDISCIPLINARY APPROACH

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Introduction

Adolescent Idiopathic Scoliosis is a complex three dimensional torsional deformity of the spine and trunk occurring in children in good general health that may progress in association with multiple factors during each rapid period of developmental growth. The most suitable age at which they should be carried out is from 10 to 16 years old. The diagnosis is made by radiography measuring the Cobb angle, which should be ≥10º, classifying it in mild scoliosis, 10º-25º, moderate curves, 25º-45º, and severe curves, >45º. The aim of the treatment is to stop the progression of the curve and decrease it if it's possible using PSSE alone, for mild scoliosis, and PSSE and brace prescription for moderate curves, following the SOSORT GPC criteria. Rigo Concept proposes an interdisciplinary approach using the same principles for PSSE and brace design.

Objective (s)

Assess the effectiveness of Rigo Concept PSSE and brace design in mild and moderate AIS following the SOSORT GPC criteria as an interdisciplinary approach.

Study Design

Multi-center prospective study on a sample of mild and moderate Adolescent Idiopathic Scoliosis treated with Rigo Concept PSSE and Brace design in Bulgarian and Spanish population.

Methods

This is a prospective multi-center study, made in Bulgaria and Spain, treating mild and moderate AIS with Rigo Concept PSSE and Brace design. The protocol included Rigo Concept principles applied to PSSE and Brace design, like 3D postural correction, expansion technique, muscle activation and integration. Exercises made one hour every week and brace was prescribed to use full-day. The inclusion criteria: AIS patient with Cobb angle between 10º-45º, Risser 0-4, age 10-16.

Results

The study group was divided in 2 sub-groups considering the treatment needs. 34 patients in the mild scoliosis, and 45 with moderate curve.

The mild group consisted of 86% females and 14% males, age 12±1.9 years old, Cobb angle 19±1º, scoliometer Th 6±9; Lum 4±3. 9 patients (45%) remained stable decreasing the Cobb angle less than 5º, average 2º. 39,2% of the patients decreased the Cobb angle more than 5º, 54,7% kept stable and 6,1% progressed.

The moderate group consisted of 90% females and 10% males, age 13±1.8 years old, Cobb angle 36±9º, scoliometer Th 10±3; Lum 9±3. 45% remained stable decreasing the Cobb angle less than 5º, average 2º. Thoracic Cobb angle average correction was 17,9º, Lumbar Cobb angle average correction was 12,9º.

Conclusion and significance

The Rigo Concept interdisciplinary approach showed effective in the treatment of mild AIS and combining PSSE and brace design applying the same knowledge in both treatments showed effectiveness for moderate AIS based on SOSORT GPC criteria. A RCT study is needed to confirm these results. It's important to identify better the factors leading to the reduction.

Acceptance type: Poster

Poster 1

THE RELATIONSHIP BETWEEN COBB ANGLE AND INFLAMMATION PARAMETERS İN PATIENTS DIAGNOSED WİTH SCOLIOSIS

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Introduction

Scoliosis is a condition characterized by a three-dimensional abnormal rotation of the vertebrae. The precise mechanism underlying the development of scoliosis remains uncertain. However, several factors have been identified that may contribute to its formation. These factors include the structure of connective tissue, the content of paraspinal muscles, the level of growth hormone secretion, the impact of vestibular functions on axial posture, the level of melatonin hormone affecting growth rate, genetic factors, and the presence of spondylolisthesis.

Objective (s)

In this study we aimed to examine the relationship between inflammatory parameters and Cobb angle in patients diagnosed with scoliosis.

Study Design

This retrospective study was conducted at a tertiary rehabilitation center.

Methods

Demographic information of the patients (age, gender, etc.), Cobb angle to be measured in the radiography examination, CRP, erythrocyte sedimentation rate, RDW, NLR (neutrophil lymphocyte ratio), CRP/albumin ratio, systemic immune-inflammation index (neutrophil number × platelet count)/lymphocyte count), systemic inflammation response index (neutrophil count × monocyte count/lymphocyte count), total inflammation systemic index (neutrophil count × monocyte count × platelet count/lymphocyte count), prognostic nutritional index (albumin level + lymphocyte count). /5), RDW (red cell distribution width), hematocrit level, high density lipoprotein (HDL), low density lipoprotein, neutrophil/HDL ratio, lymphocyte/HDL ratio, monocyte/HDL ratio, platelet/HDL ratio, CRP/HDL ratio neutrophil/LDL ratio, lymphocyte/LDL ratio, monocyte/LDL ratio, platelet/LDL ratio, and CRP/LDL ratio in blood tests were analyzed retrospectively.

Results

A total of 42 patients with scoliosis were included to our study. The mean age of the patients were 36.9 ±23.27. The mean of Cobb angle was 22.95± 14.57 degrees. A statistically significant correleation was detected between Cobb angle and erythrocyte sedimentation rate (r:0.366). A similar significant positive correleation was also found between Cobb angle and RDW (r: 0.360). It was also revealed that the parameters with a negative significant correlation with Cobb angle were monocyte count (r:- 0.399), prognostic nutritional index (r:-0.326), and total inflammation systemic index (r:-0.309).

Conclusion and significance

The study findings indicate a correlation between the Cobb angle and parameters including erythrocyte sedimentation rate, monocyte count, RDW, prognostic nutritional index and total inflammation systemic index. Further investigations are warranted to assess the potential utility of these parameters in predicting scoliosis prognosis and monitoring disease progression.

Poster 2

DECREASED ESTROGEN RECEPTOR 1 (ESR1) IN MUSCLE STEM/PROGENITOR CELLS AT CONCAVE SIDE CONTRIBUTES TO ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

Adolescent Idiopathic Scoliosis (AIS) is a common pediatric skeletal disease highly occurred in females. The pathogenesis of AIS has not been fully elucidated, while imbalanced paraspinal muscle is one of the hypotheses.

Objective (s)

To investigate the potential pathology of AIS with abnormal paraspinal muscle stem/progenitor cells.

Study Design

A basic study.

Methods

In situ immunofluorescent staining was used to analyze related parameters of paraspinal muscle stem/progenitor cells. Single cell RNA sequencing data was analyzed to find the differences between bilateral muscle stem/progenitor cells. These differences were confirmed in a number of AIS patients. Small molecules, gene knockout, gene knockdown, Western blot and luciferase reporter assay were performed to clarify the function and mechanism of Estrogen Receptor 1 (ESR1) in muscle stem/progenitor cells, and further investigate the outcome of abnormal ESR1 signaling in muscle stem/progenitor cells for AIS. Asymmetric ESR1 signaling of paraspinal muscle was performed in bipedal mouse and spinal alignment was evaluated. Selective estrogen receptor modulators Raloxifene was used to investigate its function in increasing differentiation ability of concave muscle stem/progenitor cells and alleviating the curve progression of bipedal scoliosis mice.

Results

There was fiber type related abnormality of paraspinal muscle stem/progenitor cells, which was correlated with initiation and progression of AIS. In addition, we also found decreased ESR1 (Estrogen

Receptor 1) expression in muscle stem/progenitor cells from the concave side of AIS patients. Furthermore, ESR1 is required for muscle stem/progenitor cell differentiation and disrupted ESR1 signaling leads to differentiation defects. The imbalance of ESR1 signaling in the para-spinal muscles induces scoliosis in mice, while reactivation of ESR1/Akt/CREB/Myh signaling at the concave side by an FDA approved drug Raloxifene alleviates the curve progression.

Conclusion and significance

The asymmetric inactivation of ESR1/Akt/CREB/Myh signaling is one of the causes of AIS. Reactivation of ESR1 in para-spinal muscle at the concave side could be a new strategy to treat AIS.

Poster 3

FUNCTIONAL SCOLIOSIS: THE RELATIONSHIP WITH VERTEBRAL ROTATION, SACRAL SHELF OBLIQUITY AND LIMB LENGTH INEQUALITY AT 12 MONTHS OF FOLLOW-UP.

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Introduction

Functional scoliosis (FS) is a large curve, <10° Cobb, non-rotational, correctable, and often secondary to leg length inequality (LLI). Contrasting what is often reported in the literature, in a previous study, we demonstrated the presence of vertebral rotation (VR) in FS secondary to LLI and the relationship between LLI, sacral shelf obliquity (SSO), and VR. The implication of this relationship remained unknown.

Objective (s)

This study aimed to confirm the relationship between LLI, VR, and SSO at 12 months of follow-up and observe the role and evolution of vertebral rotation in FS due to LLI.

Study Design

The study was a retrospective evaluation of VR, LLI, and SSO measured on x-rays.

Methods

23 patients of 89 had repeated x-rays at 12 months. We measured the LLI at the level of the femoral heads and SSO at the level of the first two foramina; VR was calculated using Perdriolle's method. We compared the measurements obtained after 12 months (T1) with those obtained in a previous study (T0). Repeated measures linear mixed models and multiple regression analysis were performed with statistical significance set at p<0.05.

Results

The mean VR value of 23 patients was 5.21°±4.38° at T0 and 8.04°±5.16° at T1; the mean value of SSO was 3.21±2.39 mm at T0 and 2.92±2.66 mm at T1, the mean value of LLI was 7.13± 4.15mm at T0 and 8.04 ±4.32 mm at T1. For VR, the main effect of time was statistically significant (p=0.02), while for SSO (p=0.65) and LLI (p=0.12), the impact of time was not statistically significant. According to previous study results, a significant relationship between the VR and SSO at 12 months of follow-up (R^2 0.32p=0.0003)

was confirmed. While in a previous study, we could predict for every mm of SSO a VR of 0.58°, in the present study, the prediction of VR was 0.96° for every mm of SSO. (Fig 1)

Conclusion and significance

In the literature, the differential diagnosis between FS and scoliosis is often based on the absence of VR. We confirm that FS secondary to LLI can cause vertebral rotation and that VR and SSO are in a direct and quantitative relationship. Moreover, at 12 months of follow-up, VR shows a statistically significant increase, as well as the relationship between VR and SSO. Based on this study, FS secondary to LLI could lead to a developmental rotation over time and should, therefore, not be underestimated, mainly if it arises at the moment of peak high velocity.

Poster 4

CORRELATION ANALYSIS OF PARAVERTEBRAL MUSCLE ACTIVATION AND 3D PARAMETERS IN APEX VERTEBRA IN ADOLESCENT IDIOPATHIC SCOLIOSIS: A PRELIMINARY STUDY OF MAJOR THORACIC CURVATURE

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Introduction

Paravertebral muscle activation features may be associated with the progression of scoliosis. Previous studies analyzing paravertebral muscle activation have been inconsistent with two-dimensional coronal analysis, which has limited the overall understanding of complex 3D deformities.

Objective (s)

In this study, we analyzed the potential correlation between paravertebral muscle activation characteristics of parietal vertebrae and spine-pelvic 3D parameters for major thoracic curvature types with coronal imbalance of the spine and risk of progression

Study Design

The cross-sectional study design was implemented and approved by the Human Experiment Review Committee of Guangzhou Institute of Physical Education (2018LCLL-008).

Methods

G-power 3.1.7 software was used to estimate the sample size, and the difference in the ratio of concave/convex surface myoelectric RMS was reported in relevant literatures. Significance level $\alpha=0.05$, test force $\beta=0.95$, Effect size $d=0.35$ were set, and the estimated sample size was 34 cases.RMS values of sEMG of the paravertebral muscle at the T8 position were analyzed in the standing position.Simultaneous frontal and lateral images of the entire spine were taken using the EOS imaging system. To obtain the following 3D radiological parameters:①Overall balance parameters: C7PL-CSVL and SVA.② Regional balance parameters: RSH, LPT and Cobb Angle③ Local balance parameters: AVT, TK,LL SS、PI、PT、AVR,and PAR. SPSS23.0 software was used for statistical analysis. When the comparison data of RMS values met the normal distribution and homogeneity of variance, paired T-test was used for comparative analysis.RMS ratios and radiological 3D parameters were tested for any correlation using stepwise multiple linear regression analysis.

Results

The RMS value of the main thoracic curve was higher on the convex side than on the concave side ($P < 0.05$). AVR, C7PL-CSVL, TK and LPT were the relevant variables in the regression analysis of the ratio of

the dependent variable T8RMS, respectively (R2=0.78).The regression model equation was as follows: T8Ratio=0.736-0.055AVR+0.126C7PLCSVL+0.17LPT-0.20TK.

Conclusion and significance

In this group of AIS patients, the activation of the paravertebral muscle of the main thoracic curved apex was more convex than concave.The RMS ratio of paravertebral muscle at the apex of thoracic main curve was exponentially correlated with AVR, C7PLCSVL, LPT and TK,among which the TK had the greatest effect.

Poster 5

CURRENT KNOWLEDGE OF CHIROPRACTIC STUDENTS ON ADOLESCENT IDIOPATHIC SCOLIOSIS IN THE USA

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Introduction

Chiropractors are professionals who specialize in spine conditions. The curriculum of chiropractic schools includes spine anatomy, embryology, physiology and biomechanics of the spine, but no systemic knowledge about adolescent idiopathic scoliosis (AIS). Prior research suggests that students pursuing other health professions across the globe might not possess a sufficient comprehension of AIS about SOSORT guidelines. However, there was no similar study from chiropractic schools. Therefore, it is warranted to look into doing a comparable study on the knowledge of AIS from enrolled chiropractic students.

Objective (s)

The purpose of this study was to understand the level of basic knowledge of AIS in chiropractic students trained in the United States.

Study Design

Observational retrospective study.

Methods

The study included quiz questions that assessed knowledge of basic concepts related to AIS, such as diagnosis, assessment, and treatment. These were some of the quiz questions from the spinal anatomy course. One hundred thirty exam copies were selected at random. The quizzes were taken in the second trimester, as part of the spinal anatomy. Examinees of spinal anatomy having previously completed neuroanatomy and general anatomy, including the extremities anatomy. Of the quizzes' 40 questions, 10 were to understand AIS, and used for study analysis.

Results

The results suggested that there were differing degrees of understanding of AIS etiology. For instance, almost 99% of answers were correct on the question that AIS was the most common among all spine deformity; however, only 32% answers were correct that AIS was a 3D deformity, and 68% of answers were correct that AIS was a developmental issue. The other answers of quizzes were likewise inconsistent. While 92% of answers were aware of the general classification, only 25.33% of answers selected radiology as a golden standard diagnostic tool. When questioned if scoliosis could be prevented in its onset or progression, 69% said it could be prevented in its onset, while 80% said it could be

prevented in its progression. 100% of the answers agreed that chiropractors should be involved in treating AIS.

Conclusion and significance

Results from this study were mixed, indicating that chiropractic students within the United States had some level of knowledge but not sufficient to deal with clinical changeling. Chiropractic students may be able to comprehend AIS better if scoliosis knowledge is incorporated into their education.

Poster 6

POSTURAL HABITS AND LIFESTYLE FACTORS ASSOCIATED WITH ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) IN CHINA: RESULTS FROM A BIG CASE–CONTROL STUDY.

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Introduction

Adolescent idiopathic scoliosis (AIS) is the most prevalent type of scoliosis afecting children between the ages of 10–16 years. However, risk factors for AIS, particularly the modifable ones, are still largely unknown.

Objective (s)

To investigate the associations of lifestyle and social environment factors with AIS in Chinese schoolchildren.

Study Design

A matched case–control study.

Methods

This is a matched case–control study based on survey data collected from school-based scoliosis screening program. We used conditional logistic regression models to describe the relative risk of AIS incidence for each variable in the analyses. To examine the independent efect of each factor on developing AIS, a multivariate conditional logistic regression was conducted and odds ratios (ORs) were adjusted for age and other signifcant variables.

Results

Overall, 2538 participants from 49 schools were included in this study, comprising 1269 AIS cases and 1269 controls. Mean age of the study population was 13.4 years±1.06 (range 10–18). One thousand fve hundred and fifty (61.1%) of the study subjects were girls. After adjusting for other signifcant factors, inappropriate desk heights, either too low (OR=1.40, 95% CI 1.04–1.90) or too high (OR=1.61, 95% CI 1.09–2.38), standing with anterior pelvic tilt (OR=2.73, 95% CI 1.41–5.28), and sleeping on the right side (OR=1.38, 95% CI 1.00–1.91), remained associated with elevated AIS risks. In contrast, sitting normally and classroom sitting positions change regularly were associated with lower odds of AIS. The adjusted

ORs were 0.69 (95% CI 0.50–0.96) for sitting normally, and 0.72 (95% CI 0.53–0.98) for sitting positions change.

Conclusion and significance

This is the frst study to address the associations between desk heights and AIS and showed inappropriate desk heights were related to increased AIS risks. To protect school children from developing AIS, stakeholders are advised to consider introducing height-adjustable desks in the class, changing students' sitting positions in the classroom on a regular basis, and implementing educational programs to help students maintain correct sitting postures.

Poster 7

THE CHARACTERISTICS OF SCOLIOSIS PATIENTS PRESENTING TO A PRIVATE CLINICAL NETWORK IN AUSTRALIA

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Introduction

Healthcare professionals, politicians, and policy makers rely on accurate epidemiological data to guide decision making and inform approaches to prevention, screening, diagnosis and management of a particular disease. There is currently a paucity of specific epidemiological data regarding scoliosis and related spinal deformity for the Australian population.

Objective (s)

The aim of this manuscript is to describe the demographic, anthropometric and clinical characteristics of patients presenting with scoliosis or related spinal deformity based on records from an Australian primary care (ScoliCare Australia) research database.

Study Design

A retrospective chart review of patients who attended Australian scoliosis clinics (ScoliCare, Australia) between August 2018 and August 2023.

Methods

Demographic, anthropometric, and clinical characteristics were captured from all patients who consented to having their de-identified data placed on the research database. Descriptive statistics were produced for all quantitative data. Free text responses regarding the reason for the consultation and the working diagnosis for each patient were analysed using thematic analysis and summative content analysis respectively. Macquarie University Human Research Ethics approval number: 5201826252998.

Results

The records of 271 consecutive patients, 77 (28%) males and 194 (72%) females were included in the study. The median age at the time of initial consultation was 19 years (Range = 4-83). The vast majority (88%) of patients presented with scoliosis. The primary curve was typically right-sided (56%), with a median Cobb angle of 32 degrees (IQR = 23). Primary coronal plane curves were located in the thoracic region most commonly (48%). 80% of patients attending the clinics stated that they had pain (VAS scores, median=5/10, IQR = 3) at the time of the initial consultation. This pain was most frequently (38%) experienced in the lower trunk/pelvis. The most common working diagnosis recorded at the time of the initial consultation was that of Adolescent Idiopathic Scoliosis (AIS) in 33.5% out of 275 patients, followed closely by Progressive AIS in adults at 28.4%.

Conclusion and significance

The findings from this study highlight the demographic, anthropometric and clinical characteristics of scoliosis and related spinal deformity patients who visited primary care scoliosis clinics in Australia. Region-specific epidemiological studies are required to better understand and enumerate this subgroup of the population. This will allow for more accurate approaches to prevention, screening, diagnosis and/or management of scoliosis and related spinal deformity in this region.

Poster 8

ACCURACY OF SCREENING FOR ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS): A PROSPECTIVE SCREENING METHODS STUDY

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Introduction

Scoliometer has been proven to be an effective screening method. However, the cuttoff of scoliometer for screening are still controversial.

Objective (s)

To assess the scoliosis screening method using scoliometer combined with physical examination.

Study Design

A single-center prospective observational study.

Methods

Patients with scoliosis or suspected scoliosis, patients with non-scoliosis, and healthy volunteers were enrolled. They were all conducted a scoliosis screening using a combination of visual inspection, FBT and ATR measurement, and confirmed diagnosis by standing whole spine X-film or spine ultrasound. We compared the Non-AIS individuals and AIS patients in terms of the baseline demographic variables and the clinical characteristics using Fisher's exact test or χ2 test for categorical data and t-test for continuous variables. We used a receiver operating characteristic (ROC) curve to identify the optimal ATR cutoff point, and selected the cutoff value with the highest AUC as the optimal one. Furthermore, a series of logistic regression models were used to identify ATR value in which combination of clinical signs could best predict AIS.

Results

A total of 595 patients were included. The non-scoliosis group consisted of 136 persons, and the scoliosis group included 459 patients. The average main Cobb angle of AIS patients and non-AIS persons were 21.1˚ ± 8.1˚ and 4.0˚± 3.9˚. Levels of ATR index were significantly higher in AIS group (7.3 ± 3.4 degress) compared with non-AIS group (3.6 ± 3.2 degrees). An optimal ATR cutoff value of 6.25° was identified for distinguishing between AIS and non-AIS participants, with an AUC of 0.78 (95% CI: 0.74-0.82). At this cutoff value, the ATR indicator demonstrated a sensitivity of 62.5% (95% CI: 57.9%-66.9%) and a specificity of 79.9% (95% CI: 72.0%-86.0%). when the ATR index of 6.25° is used in conjunction

with more than two positive physical signs, it presents a higher diagnostic accuracy than the sole use of the ATR index at a threshold of 6.25˚ (79.4% V.S 66.6%).

Conclusion and significance

The screen techniques we studied are effective in detecting AIS among Chinese adolescents. In this study, our results showed that scoliometer reading of 6.25°combined with two more physical clinical signs is the best cut-off value for referring, which may be potentially to developed as a standard screening protocol for AIS screen programs.

Poster 9

EFFECT OF ADOLESCENT IDIOPATHIC SCOLIOSIS ON MOBILITY AND TRUNK OSCILLATION

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Introduction

The deformity resulting from adolescent idiopathic scoliosis (AIS) affects bilateral control of the paravertebral muscles, increasing trunk oscillation when compared to control groups

Objective (s)

Verify trunk mobility and oscillation in the progression of adolescent idiopathic scoliosis

Study Design

Cross-sectional study

Methods

178 adolescent patients, aged 10 to 17 years, with a Cobb angle between 10 and 110º were included. Patients were grouped according to the degree of scoliotic curvature, according to the SOSORT guidelines, 10 to 25º mild curves, 25 to 45º moderate curves, 45 to 60º severe curves and curves ≥60º very severe curves. The variables were evaluated carried out using an inertial sensor composed of a triaxial accelerometer, a magnetic sensor and a triaxial gyroscope (BTS G-walk®).

Results

When evaluating extension ($p=0.415$), rotation ($p=0.466$), trunk inclination ($p=0.916$), trunk oscillation with anteroposterior eyes open ($p=0.133$), area of oscillation ($p=0.083$) of eyes closed, anteroposterior ($p=0.323$) and mediolateral ($p=0.55$) trunk acceleration with eyes closed, there were no statistically significant findings in the means between the groups. However, when evaluating flexion ($p=0.041$), which there was a statistically significant result, but there were no differences greater than 5 points between the group means, as for the speed of trunk oscillation with eyes closed ($p=0.011$), area trunk oscillation with open eyes ($p= 0.020$), trunk acceleration with eyes open anteroposterior ($p=0.014$),

trunk acceleration with eyes open mediolateral (p= >0.001), average trunk oscillation speed -lateral with eyes open (p= 0.044), it was evident that the greater the severity of the scoliotic curvature, the lower the averages.

Conclusion and significance

During the progression of scoliosis, there is a decrease in the speed of trunk acceleration. In other words, the greater the scoliotic curvature, the lower the trunk oscillation speed.

Poster 10

KNOWLEDGE OF PHYSIOTHERAPISTS FROM POLAND AND THE CZECH REPUBLIC ON THE DIAGNOSIS AND TREATMENT OF IDIOPATHIC SCOLIOSIS

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Introduction

According to the guidelines of the International Society on Scoliosis Orthopaedic and Rehabilitation Treatment (SOSORT), so-called specific physiotherapy plays a key role in treating mild and moderate idiopathic scoliosis (IS).

Objective (s)

The study aimed to determine the level of knowledge of physiotherapists from Poland (PLP) and Czech Republic (CRP) about IS and its physiotherapeutic treatment.

Study Design

Comparative study.

Methods

The study included 263 and 219 PLP and CRP, respectively.

The study used a questionnaire developed based on SOSORT recommendations

One point was awarded for a correct answer, an incorrect or no answer meant 0 points. The questions were divided into three parts: 1) characteristics of IS, 2) diagnostics and treatment of IS, 3) physical activity of subjects with IS. 100-90% of correct answers meant full, 89-60% – good, 59-50% – average, and < 50% – low knowledge.

Statistical analysis was performed using Statistica 13.3, including the Mann-Whitney U, the Kruskall-Wallis and the Dune tests. The level of significance was $\alpha < 0.05$.

Results

PLP and CRP had good knowledge about the characteristics of IS, with a higher score for PLP (6.8 ±1.3 vs 6.1 ±1.4, p=0.000). For diagnostics and treatment, the knowledge of PLP was good and higher compared to CRP (21.4 ±5.9 vs 17.9 ±3.6, p=0.000). PLP and CRP present an average knowledge about physical activity (7.2 ±2.0 vs 6.8 ±1.8, p=0.044).

The knowledge of PLP was positively influenced by the completion of specific physiotherapy courses (IS characteristics p=0.000; diagnostics and treatment p=0,001) and work experience (IS characteristics p=0.000; diagnostics and treatment p=0.003). CRP who completed courses other than those related to specific physiotherapy had a higher level of knowledge (IS characteristics p=0.000; diagnostics and treatment p=0.003). The work experience positively influenced the level of knowledge of CRP only for IS characteristics (p=0.018).

The level of knowledge was not influenced by the workplace (IS characteristics p=0.056, p=0.523; diagnostics and treatment p=0.379, p=0.782; physical activity p=0.060, p=0.136 for PLP and CRP, respectively).

The knowledge of PLP and CRP regarding physical activity of subjects with IS was not influenced by course completion (p=0.055, p=0.441, respectively) and work experience (p=0.514, p=0.318, respectively).

Conclusion and significance

1. Physiotherapists from Poland and Czech Republic present a good knowledge about the characteristics of idiopathic scoliosis. However, the PLP have a higher knowledge in this area.

2. The knowledge of PLP on the diagnostics and treatment of IS is good and higher than CRP.

3. PLP and CRP present average knowledge about the physical activity of subjects with IS.

4. Completion of postgraduate courses and work experience have a beneficial impact on the knowledge of physiotherapists. Therefore, postgraduate training should be promoted for physiotherapists wishing to treat subjects with IS.

Poster 11

EARLY RESULTS OF A VIRTUAL SCOLIOSIS BRACING MULTIDISCIPLINARY MEETING

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Introduction

In recent times since COVID-19, waiting lists for consultant appointments are extensive for both new and routine review. Children are waiting long periods to be reviewed and assess for bracing. Our trust began a virtual Scoliosis Bracing Multidisciplinary Meeting (MDT) to regularly review and manage patients. Patients are being braced via the Scoliosis Research Society (SRS) criteria.

Objective (s)

To evaluate the quality service improvement within the department since starting the virtual MDT.

Study Design

Retrospective review.

Methods

We retrospectively analysed our cohort of braced patients from 2019 to 2023. We developed a quarterly annual meeting where all braced children had their X rays reviewed 1-2 times per year. This complimented their annual surgical and orthotic meetings (face to face) as a minimum. We looked at their diagnosis, radiographic parameters and demographics in order to determine the impact as a Quality Improvement Service.

Results

We treated 155 patients in brace between 2019-2023. There were 70.9% idiopathic and 27% syndromic or neuromuscular/atypical. There were 18.9% early onset (EOS), there were 52% after the age of 10 (AIS). The mean cobb angle at referral for idiopathic scoliosis was lumbar 38 degrees, thoracic 37 degrees; for neuromusclaur/syndromic curves the average was 48 degrees. The mean age at referral was 11 years old. The main gender were female (70%) as expected. There was a mean 9 month delay between GP referral into service and first outpatient assessment. Prior to Virtual MDT 60% of patients had no assessment in one year.

MDT safety nets resulted in routine guaranteed 6 monthly virtual assessments. Once reviewed, some children received 3 monthly, 9 monthly or annual depending on circumstances.

Conclusion and significance

The bracing MDT has meant that 100% of our patients are reviewed virtually between 1-2 times each year as appropriate. We have a mixed cohort of idiopathic, early onset, syndromic and neuromuscular. The guaranteed MDT review is important when the expected annual face to face review is often cancelled or missed.

Further research is required to analyse the outcomes of being braced within a Virtual Scoliosis Bracing MDT.

Poster 12

PROFILE OF SPORTS ACTIVITY PRACTICE IN PATIENTS WITH SCOLIOSIS

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Introduction

Engaging in sports activities brings substantial health benefits, enhancing overall quality of life. However, individuals with different deformities may harbor concerns that such activities could potentially cause harm. Idiopathic scoliosis, affecting approximately 3% of the population, primarily girls, manifests as a progressive three-dimensional condition affecting the spine and trunk. The regular practice of sports activities increases the odds of improvement in adolescents undergoing conservative treatment with braces and specific exercises.

Objective (s)

To describe the frequency and types of sports activities practiced by individuals diagnosed with idiopathic scoliosis.

Study Design

Retrospective descriptive study.

Methods

A database containing information on 255 patients was accessed, with an initial 100 patients arbitrarily selected based on eligibility criteria. Data related to engagement in sports activities, participation in physical education at school, and the frequency of these activities were collected during the first consultation. Analysis involved descriptive statistics, encompassing mean, standard deviation, and frequency distribution.

Results

The sample was composed of 100 patients, including 27 adults and 73 adolescents, of which 75 were female. The mean age was 16.7±8 years, height 1.6±0.1m, and body mass 48.8±13kg. There were 63 curves in the thoracic region with a mean cobb angle of 35.7°±15.7° and 80 curves in the lumbar region with a mean cobb angle of 29.8°±13.6°. Among these individuals, 24 were sedentary, while 76 were engaged in different sports activities, encompassing 18 adults and 58 adolescents. Prominent activities included participation in physical education at school, diverse forms of dance, Pilates, and weight training at the gym. Among the active participants, engagement frequency ranged from once to six times per week, with 35.5% reporting engagement twice a week, while only one subject reported engagement six times per week.

Conclusion and significance

This research observed that 76% of individuals diagnosed with idiopathic scoliosis engaged in some form of sports activity. The activities exhibited diversity both in terms of modality and frequency, typically excluding high-impact activities. A notable concern highlighted in this study was the high percentage (24%) of sedentary individuals. Encouraging this population to commence sports activities should be a key objective in the treatment of idiopathic scoliosis.

Poster 13

SCREENING FOR SPINE AND FEET IN CHILDREN FROM 7 TO 13 YEARS OF AGE IN BULGARIA

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Introduction

Currently, in Bulgaria, there is no general, standardised system of screening tests aimed at early detection of spinal curvatures, flat feet and these causes. Lack of standardisation can lead to false-negative or false-positive test results.

Objective (s)

Selection of functional tests for quick, qualitative assessment of posture and steps in children from 7 to 13 years of age suitable for a screening study in schools.

Study Design

This is a multicentric scoliosis screening research project and feet.

Methods

In the period of one school year in Bulgaria (2022/23), we examined 1791 children from 7 to 13 years of age. The examination included a view of the posture in the frontal and sagittal planes. Measuring the sagittal profile using an inclinometer. Measurement of the angle of trunk rotation with a scoliometer. Examination of the feet and determination of flat feet. Proprietary methodology for squat testing and evaluation for shortened muscles. Sit and reach test.

Results

In 45% of the children, we found no changes in posture. 55% of the children had posture disorders. The angle of trunk rotation $\geq 4°$ we found is 8.4%. The angle of trunk rotation $\geq 7°$ we found at 1.4%. When examining the feet, we found 50.4% normal feet, 42% fallen arch and 7.6% flat feet. In the squat test, we found that 28% of the children failed to squat completely. In a correlation analysis, the contingency coefficient demonstrated a statistically significant correlation between flat feet and the ability to squat 0.255 ($p=0.002$). This relationship is not linear, which gives us reason to assume that there are additional factors that influence the obtained result.

Conclusion and significance

The results obtained for spinal conditions and scoliosis correspond with similar studies around the world. The inability to squat in children is related to their general flexibility. We think more research is needed on the inability to squat in children.

Poster 14

DIAGNOSTIC ACCURACY OF CLINICAL SCREENING TOOLS FOR GENERALIZED JOINT HYPERMOBILITY AND INHERITED CONNECTIVE TISSUE DISORDERS IN PATIENTS WITH SCOLIOSIS - A SYSTEMATIC LITERATURE REVIEW

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Introduction

The validity of clinical screening tools for GJH and HCTDs is underreported and inconsistent. The prevalence of GJH and HCTDs in patients with scoliosis is significantly higher compared to the general population.

Objective (s)

To systematically review the Diagnostic Accuracy (DA) of current GJH and ICTD CSTs in patients with scoliosis and report on the validity of each tool to precipitate future research on hypermobility screening and the impact of scoliosis management and etiology.

Study Design

Systematic Review

Methods

An electronic search of PubMed, CINAHL, Scopus and Embase combined the following keywords and synonyms: Generalized Joint Hypermobility, Screening Tools, Diagnostic Tools, Ehlers Danlos Syndrome, Connective Tissue Disorders, and Scoliosis. Study designs included Meta-Analysis, Systematic Review, DA, and Cross-sectional Studies. Exclusion criteria included studies not assessing our review question, screening procedures that could not be performed in a clinical setting, or not published in English. Initial search yielded 4789 studies. After removing duplicates and screening by two reviewers (KB, NY), the review included 26 articles, 16 from a manual search. Following a quality assessment using the QUADAS-2 and a Systematic Review appraisal guide, the level of evidence for each screening tool was synthesized.

Results

There are no studies assessing the DA of CST for GJH or HCTDs in patients with scoliosis. We found no CSTs for HCTDs applicable to our review question. For GJH we found: Beighton Score (BS), modified versions of the BS, Hospital Del Mar, Five Point Questionnaire(5PQ), Upper Limb Hypermobility Assessment Tool (ULHAT), Self-reported screening questionnaire (SQ-CH), Glenohumeral abduction, the Lower Limb Assessment Score(LLAS), absent inferior labial or lingual frenula and glenohumeral

abduction measurements. The BS was used as a reference standard with varying thresholds and methodology in most studies. No screening tools had moderate or strong level of evidence. All screening tools had limited evidence at best varying based on age. There is no evidence on the diagnostic accuracy of CSTs in individuals with scoliosis. The Beighton Score has limited evidence with varied sensitivity and specificity based on cutoffs and population age. For a cutoff of ≥4 in adults, Sn μ78.7% σ7.1 and Sp μ83.4% σ27.2.

Conclusion and significance

There are no gold standard CSTs for GJH/HCTDs. Most DA studies reviewed have high risk of bias and the level of evidence for all CSTs is limited to none. A composite CST along with a thorough clinical assessment may improve DA, but more low bias research is needed.

Poster 15

TETHERED CORD SYNDROME IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS; COURSE AND TREATMENT, A PATIENT'S EXPERIENCE

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Introduction

Tethered Cord Syndrome (TCS) as an etiology of Adolescent Idiopathic Scoliosis (AIS) is becoming more acknowledged. However, many providers who treat scoliosis are unaware of this condition, and its impact on patients. In some cases, patients who have scoliosis but show limitations in their ability to do certain exercises, or do not show signs of progress, have undiagnosed tethered cord syndrome, and can be harmed in performing scoliosis specific exercises.

Objective (s)

To prevent potential harm of TCS from scoliosis exercises by educating providers on: what tethered cord syndrome is, how to identify it in patients with AIS, what exercises and treatments to avoid, and when to stop or resume Schroth and other scoliosis specific exercise methods accordingly.

Study Design

Patient Experience

Methods

The author underwent an urgent tethered cord release surgery in May 2023, having just been diagnosed with tethered cord syndrome (TCS) in April. She had been diagnosed with scoliosis 18 years prior, and had struggled in spite of intensifying non-surgical scoliosis treatment, and finding that the scoliosis exercises could create as much harm as they could help her.

Results

The author will share her experiences as a patient in different stages throughout her life, including pre and post initial scoliosis diagnosis, post traumatic spinal injury and microdiscectomy, and post tethered cord release surgery. These experiences will be used to help identify asymptomatic tethered cord syndrome and acute tethered cord syndrome. She will describe the sensations and symptoms she felt in relation to her curvature and the treatments she underwent.

The author will describe both the positive and the negative impacts of Schroth and other non-surgical scoliosis exercise methods on the condition. The author will also discuss the potential of a patient needing surgery when the body is unable to perform the exercises, leading to the exercises exacerbating symptoms, and what post operative recovery and treatment look like. She will also detail how she is

now able to perform the same scoliosis exercises without the pain and restrictions she experienced before the surgery, and with a greater impact on changing her scoliosis rotation.

Conclusion and significance

Increasing awareness of Tethered Cord Syndrome as a cause of Adolescent Idiopathic Scoliosis is imperative and critical for physical therapists, doctors and other providers for scoliosis patients. There is a need to be able to properly assess patients for TCS and treat them safely without causing unintentional harm, while also adjusting conservative treatment for scoliosis. The author hopes that this presentation will help to encourage adapting the available conservative management and treatment of scoliosis to include tethered cord syndrome, and that further research into TCS and its impact on scoliosis will be conducted by SOSORT.

Poster 16

PHYSIOTHERAPY SCOLIOSIS SPECIFIC EXERCISES AND THREE-DIMENSIONAL BRACING IMPROVE A SEVERE ADOLESCENT IDIOPATHIC SCOLIOSIS CURVATURE, A CASE REPORT.

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Introduction

When the Cobb angle of a curvature exceeds 45° in a skeletally immature adolescent, surgical stabilization is typically anticipated to prevent further curve progression. Initiating PSSE and 3D bracing at this stage of curve development is not widely endorsed, possibly due to the belief that they may offer little benefit and not change the outcome. However, the impact of three-dimensional corrective forces generated with PSSE and 3-D bracing should warrant consideration if they can improve a curve and reduce the need for surgical stabilization.

Objective (s)

The purpose of this case report is to describe how a highly motivated and skeletally immature patient with AIS improved her severe curvature to below the surgical threshold using PSSE and bracing treatment emphasizing 3-D correction.

Study Design

Interventional case report.

Methods

Target: Skeletally immature female (Risser < 2) with AIS and severe curvature (45 degree Cobb angle) with anticipated surgical stabilization at end of growth.

Interventions: BSPTS PSSE treatment/training (9 hours over 9 weeks). PSSE HEP 30 minutes per day x 5 days per week for 12 months, then 3 days per week X 6 months. WCR Brace (Rigo-Cheneau orthosis) worn 20+ hours per day until skeletal maturity.

Assessments/Outcomes: Serial radiographic imaging, Scoliometer, SRS-22, Numeric Pain Scale, Trunk Appearance Perception Scale.

Duration of Treatment: 18 months

Results

Before and After images attached.

Reduction in primary curve (thoracolumbar) Cobb angle from 45 to 30 degrees, reduction in TL ATR from 9 to 0 degrees

SRS-22 Improvement in function (0.2), pain (0.6) and self-image (0.6) domains.

TAPS (Trunk Appearance Perception Scale) improvement by 1.0 (from 3.0 to 4.0)

Numeric pain scale reduction from 4/10 to 0/10

Conclusion and significance

A highly motivated patient with AIS significantly improved her curvature through consistent performance of PSSE and compliance with a full-time 3D brace over 18 months of treatment, and she avoided surgery upon reaching skeletal maturity. Treatment also helped to reduce pain symptoms and improve global balance and quality of life factors. Non-operative treatment should still be considered an appropriate intervention for growing adolescents with severe curvatures. PSSE and 3D bracing may positively influence plasticity and create lasting changes within the musculoskeletal and central nervous systems, resulting in 3D curve improvement.

Poster 17

STAND-UP-PADDLING AS PART OF PHYSIOTHERAPEUTIC TREATMENT AND/OR AS A LEISURE ACTIVITY FOR CONSERVATIVELY TREATED PATIENTS WITH IDIOPATHIC SCOLIOSIS. A QUALITATIVE STUDY.

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Introduction

Stand-up-paddling (SUP) not only represents an increasingly popular trend sport, which is supposed to have positive effects on physical and mental health, but also provides indications of possible benefits especially for idiopathic scoliosis (IS) patients.

Objective (s)

The purpose of this study is to find out, which positive effects on IS are possible through the implementation of SUP in scoliosis management and how a specific implementation of this project could look like in the perspective of three IS-related physiotherapists, two doctors and one founder of a self-help-group.

Study Design

Qualitative content analysis of expert interviews

Methods

A qualitative content analysis was done based on a differentiated deductive-inductive category system of previously conducted expert interviews (N=6), which were held in March and April 2021. These were evaluated by means of qualitative content analysis according to Kuckartz, using the computer-assisted data analysis program MAXQDA, and subsequently placed in relation to literature and the research questions. Based on the outcomes an illustrative program for physiotherapeutic intervention on the SUP board for IS patients was developed.

Results

Regarding scoliosis-specific training effects of SUP, the asked experts (three physiotherapists, two doctors and one founder of an IS self-help-group) most frequently mentioned following benefits: Individual observation induced (n=7), elongation/dilation/erection of spine (n=6), spine correction by paddle stroke (n=4), spine correction by one sided paddle stroke (n=3), correction by side shift (n=1) and stabilization of pelvis (n=1).

Further general training effects of SUP, which also can have a positive influence on IS patients were improvement of: muscle strength (n=20), balance (n=11), core stability (n=10), leg posture (n=5),

motivation/compliance (n=5), body posture (n=4), cardiac endurance (n=2), coordination (n=2), scapula fixation (n=1) and ventral chain (n=1). According to the experts interviewed, those results qualify SUP as recreational recommendation in IS. Also the individual scoliosis-specific adaptation of the paddle stroke and the execution of already known PSSE on the board were endorsed by experts, associated with possible positive effects (physical and mental) on IS and recommended under the guidance of expert therapists as supplement and variety, but not as substitute for conventional conservative scoliosis treatment.

Conclusion and significance

Stand up paddling can be used in idiopathic scoliosis both as part of physiotherapeutic treatment as well as recreational recommendation and has the potential to have positive effects on physical and mental health in IS, but due to a lack of evidence should only be undertaken under individual assessment and consideration of an indication at the moment.

Poster 18

REDUCTION OF PAIN AND IMPROVEMENT OF FUNCTIONALITY IN PATIENTS WITH DEGENERATIVE SCOLIOSIS, USING PATTERN SPECIFIC SCOLIOSIS REHABILITATION - PROSPECTIVE COHORT STUDY

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Introduction

Scoliosis is a three-dimensional deformity of the trunk and spine. For adults with degenerative scoliosis the only treatment offered has been spinal fusion surgery. This patient group often reports of low back pain as well as loss of functionality and poor body alignment. We want to investigate if patient education and PSSR can reduce symptoms and increase function.

Objective (s)

We wish to investigate whether instructions in everyday corrective positions as well as pattern specific rehabilitation can reduce pain as well as increase function.

Study Design

Prospective cohort study run in ScolioFys clinic from October 2021 to October 2024.

These are the final results from the first year of the ongoing study.

Methods

Population was Adults 50+ years with scoliosis and low back pain, no prior back surgery, no prior scoliosis specific rehabilitation (PSSE/PSSR).

Assessment and outcomes: During first consultation a full assessment of the patients included: history, ATR and height measurement as well as Formetric scan of relaxed posture. Pain scale 0-10 was recorded for relaxed postions as well as activity. Questionnaires: ODI, SRS22r, Pain drawing. 6 photos of the patient in relaxed standing position were collected (front/back/sides/forward bent from back and side).

Patient was instructed in corrections to ADLs to be made new daily habits and pattern specific Schroth exercises to be performed 2-3 times weekly at home. Follow ups at 3, 6 and 12 months with the same assessment and questionnaires every follow up.

In order to find out how quickly changes happened as well as getting a larger sample size to this intermediate result, we included the results from the 3 month follow up as well as the final results after 12 month follow up.

Number of patients at 12 month follow up = 16
Number of patients at 3 month follow up = 29

Results

End results at 12 month follow up showed an average decrease in resting pain of -1,8, activity pain -2,5, improvement of ODI score by 5,4, ATR 3,5. Increase in SRS22r Total +0,6, Pain +0,8, Function +0,4, Mental +0,4, Self-image +0,5, Treatment satisfaction +1,8

Largest change: ODI from 25 to 3, SRS 22r total from 2,8 to 4,1, Pain from 8 to 0, ATR from 17 to 9 degrees.

Intermediate results at 3 months follow-up showed average decrease in: resting pain -2,2, Activity Pain -2,5, ODI -3,9 ATR -3,1

Conclusion and significance

The results of this study provide preliminary evidence that specific rehabilitation can change quality of life for patients with degenerative scoliosis with reduction of pain and increase of function. This is a small sample size but the results should warrant investigation in a larger population.

Poster 19

DEVELOPMENT AND VALIDATION OF A NEW QUESTIONNAIRE OF PHYSIOTHERAPEUTIC SPECIFIC EXERCISES OF SCOLIOSIS- QPSSE

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Objective (s)

The purpose of this study is to create a reliable and valid questionnaire for patients suffering mild and moderate adolescent idiopathic scoliosis (AIS) who have been treated with Physiotherapeutic Specific Exercises of Scoliosis (PSSE) in order to evaluate their quality of life.

Study Design

Creating and psychometric testing of a new QoL Questionnaire about Physiotherapeutic Specific Exercises of Scoliosis (Questionnaire of Physiotherapeutic Specific Exercises of Scoliosis -QPSSE).

Methods

The developed questionnaire was based on a thorough literature review as well as on authors experience. It consists of 53 questions, of which 37 have a positive meaning, 15 have a negative meaning, and one is multiple choice question, additionally there are six "open" questions. Except for the multiple choice question, all other questions are answered on a Likert scale ranging from 1 to 5 scores. 5 represents a positive meaning or very much, whereas 1 stands for a negative meaning or not at all. Questions were developed by the authors who subsequently categorized the 53 questions into the following 8 domains: physical functioning, self-image, Physiotherapeutic Scoliosis-Specific Exercises (PSSEs), psychosocial functioning, cognitive functioning, compliance, motivation and pain. A pilot study was conducted so that we could calculate Cronbach's Alpha based on the outcome. Due to the COVID-19 pandemic, the authors worked through the Zoom online platform to structure the questionnaire.

Results

Pearson's correlation coefficient was used for all correlations evaluated. P values of less than 0.05 were considered to be significant. Internal consistency was evaluated with Cronbach's alpha. Although there were very few missing values, accounting for 0.78% of the total values of the questionnaire, expectation maximization likelihood algorithm was used to impute data. IBM® SPSS® Statistics Software v.25 was used for the analysis. Cronbach's alpha coefficients for the overall score was 0.84.

Conclusion and significance

This original QPSSE was found to be a reliable and valid tool for AIS treated conservatively with PSSE and for their clinicians.

Poster 20

EFFECTIVENESS OF SCROTH PHYSICAL THERAPY PROGRAM ON CURVE PROGRESSION IN ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) WITH AND WITHOUT BRACING INTERVENTION- A RETROSPECTIVE STUDY

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Introduction

Adolescent idiopathic scoliosis (AIS) is a common spinal deformity in children whose management depends on the curve magnitude and the child's skeletal maturity. Children often undergo bracing with or without physiotherapy scoliosis-specific exercises (PSSE) to prevent curve progression. Although brace intervention has proven efficacy in limiting curve progression, when worn for >/13 hours/day, there remains uncertainty in effectiveness of nocturnal bracing alone. It has not been established if there is a greater effect at prevention of curve progression when PSSE exercises are added to nocturnal bracing alone.

Objective (s)

Can PSSE physical therapy added to bracing protocol improve Cobb angle in patient's with adolescent idiopathic scoliosis?

Study Design

Single center, retrospective evaluation of AIS patients treated between 2020-2023 with bracing alone or bracing and PSSE.

Methods

Inclusion criteria for the study is children 10-18 years, primary curves 20-40 degrees, Risser 0-3, follow up >6 months and attendance of Schroth PT sessions > 3 times. Exclusion criteria was age <10 years or >18 years, Risser >4, non-idiopathic scoliosis diagnosis, Cobb </=19 degrees or >/=41 degrees, follow up <6 months, patients with documented cognitive or developmental delay, prior surgical spinal intervention, no brace recommended or attended 2 or fewer Schroth PT sessions. Outcomes include curve magnitude at final follow-up, brace compliance, percentage of curve correction achieved within their nocturnal brace, follow-up period, patient demographics and number of patients meeting surgical criteria at conclusion of follow-up.

Results

No significant differences were found between the two groups in patient's age, gender, BMI, Risser score, initial curve magnitude or concluding curve magnitudes.

	NTB (n=46)	NTBPT (n=24)	Analysis Type	p value	95% CI
Initial Cobb (average)	30.35°	30.67°	2 Sample T-Test	p=0.8	-2.2426 to 2.8826
Concluding Cobb (average)	34.67°	36.167°	2 sample t-test	p-0.6	-7.4308 to 4.2908
Brace Compliance (average)	6.26 hours (n=40)	7.16 hours (n=23)	Mann-Whitney U	Chi^2: 0.01; p=0.939	95% Median CI (6.75,8) (7.45, 8.05)
% In-Brace Correction	65.19%	58.3%	Mann-Whitney U	Chi^2: 2.46; p=0.12	95% Median CI (0.55, 0.65) (0.448, 0.66)
Follow-Up Time	15.37 months	14.2 months	Mann-Whitney U	Chi^2: 0.69 P=0.405	95% Median CI (11,18) (11, 16.8)
Average Number of Schroth PT Sessions		11.4			
Outcome within Group from Enrollment to Conclusion	P=.02 T=2.02	P=.03 t-2.28	single T-test		

No significant differences were identified between NTB and PT patients in terms of curve progression (30% (14/46) vs. 46% (11/24), p=0.1), achievement of a surgical threshold (15% (7/46) vs. 21% (5/24), p=0.20). No difference was noted between brace compliance time.

Conclusion and significance

Addition of PSSE to a standard night-time scoliosis bracing protocol does not appear to improve prevent progression of curve magnitude, greater than nocturnal bracing alone. Nocturnal bracing compliance does not appear to improve with the addition of PSSE.

Poster 21

EFFECT OF PHYSIOTHERAPEUTIC SCOLIOSIS-SPECIFIC EXERCISES ON ACTIVATION OF PARAVERTEBRAL AND RESPIRATORY MUSCLES IN AIS PATIENTS WITH RIGO A TYPE

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Introduction

The current use of Physiotherapeutic scoliosis-specific exercises（PSSE） in adolescents with idiopathic scoliosis（AIS） has attracted attention. However, the mechanics of the exercise still need to be further confirmed. The paravertebral muscles, as effectors of the trunk postural reflex, stabilize spinal postures, while the respiratory muscles can also influence spinal postures through the ribs. Most studies have shown that the main curved and convex paravertebral muscle tends to have higher EMG activity during habitual sitting, standing or symmetrical movements. However, there are few studies on the effects of PSSE exercise on paravertebral and respiratory muscle activation.

Objective (s)

In this study, the sEMG characteristics of paravertebral muscles and respiratory muscles of AIS patients classified by Rigo A were observed during PSSE and habitual postures.The analysis of muscle activation characteristics in patients with PSSE provides a basis for the selection of AIS precision exercise therapy.

Study Design

A cross-sectional study design was used in this study. All patients and their guardians signed consent forms.

Methods

Eighteen Rigo type A patients who visited our rehabilitation center from September 2021 to December 2022 were recruited， with an average age of 14.2±1.4 years. The mean Cobb Angle of the right thoracic curve was 23.9±1.6°.

All participantss, during habitual standing, habitual sitting, self-correcting standing, self-correcting sitting, Schroth 50X, and Muscle cylinder, The DELSYS system was used to detect sEMG changes in the paraverteinal muscles (upper, apical, lower and 5th lumbar vertebrae of the main thoracic curvature) and respiratory muscles (rectus abdominis, external oblique abdominis, internal oblique abdominis, sternocleidomastoid, scalene and serrate anterior).

The activation status of the muscle was indicated by the root mean square value (RMS). Data were expressed as mean ± standard deviation.A paired T-test was used to compare the ratio of

convex/concave RMS of the left and right sides of the body and correction exercises in habitual postures.

Results

There were no differences in paravertebral and respiratory muscles between the corrected and customary sitting positions.Compared with the habitual posture, the self-correcting posture reduced the activation ratio of the scalene and paravertebral muscles of the apex vertebra. Schroth 50x training reduced the paravertebral muscle ratio of the vertex vertebra ($p < 0.05$), but increased the ratio of the lower vertebra, the fifth lumbar vertebra and the sternocleidomastoid muscle ($p < 0.05$). The muscle cylinder increases the ratio of L5 and external oblique muscle of abdomen.

Conclusion and significance

The four exercises showed different characteristics on the activation of the convex and concave paravertebral muscle and respiratory muscle in RigoA AIS patients. The potential effects of 50X and muscle cylinder exercises on increased asymmetric activation of respiratory muscles and paravertebral muscles at L5 should be further investigated

Poster 22

MODIFIED PSSE POST SPINAL FUSION FOR AN INDIVIDUAL WITH SMA III AND AIS: A TAILORED APPROACH

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Introduction

Adolescent Idiopathic Scoliosis (AIS) management includes bracing, physiotherapeutic scoliosis specific exercises (PSSE), and surgical intervention for curves classified as high-risk for progression. To date, there is no literature directing post operative physical therapy management for AIS, however PSSE schools have made recommendations for modified PSSE post spinal fusion. PSSE is a 3D postural correction individual to a patient's curve. Modifications are possible postoperatively to address the non-operative component of the curve.[1] One population that has a high prevalence of scoliosis and respiratory impairments is spinal muscular atrophy (SMA), but no literature to date has examined the benefits of PSSE in this population.[2,3,4]

Objective (s)

To demonstrate the potential benefit of modified PSSE and breathing focused interventions in addition to lumbo-pelvic stabilization and aerobic capacity in management of an individual with SMA type III and AIS post spinal fusion with functional decline.

Study Design

Case Study

Methods

A 16 year old male with SMA type III and AIS, on disease modifying therapy, presented to physical therapy for PSSE twenty months post spinal fusion (T2-L4) with functional decline and endurance postoperatively. Patient trialed conservative management including: school based, outpatient, and aqua therapy since surgery with continued functional decline, as measured by 6 minute walk test (6MWT) and self report. On evaluation, patient's walking duration was limited to 3 minutes (BORG scale > 4/10, 3/10 burning pain in lower extremity), rib cage expansion: 1cm axilla, 4cm xiphoid process, 3cm waist, and modified adams forward bend 3 degree left thoracic prominence. Patient's primary goals included transfers (floor to stand independently), navigating school without fatigue/fear of falling, and improve ability to descend ramps at school.

Results

Patient completed 9 sessions of physical therapy focused on modified PSSE, postural control, lumbo-pelvic stabilization, aerobic capacity, and functional training with breathing. Initial two sessions

consisted of energy conservation education (BORG < 3/10), postural control, breathing, and aerobic capacity. Over the subsequent seven sessions, patient tolerated progression of postural control interventions (seated/standing on unsteady surfaces), corrective breathing (seated, quadruped, standing), inspiratory/expiratory muscle trainer, lumbo-pelvic stabilization and aerobic exercise. On re-evaluation at session 5, patient demonstrated improved endurance (ambulation 5 min: 3/10 BORG, 1/10 pain) and rib cage expansion increased by 1cm at axilla and xiphoid process. At discharge, patient demonstrated improved endurance (ambulation 5 min: 2/10 BORG), improved 6MWT by 60m, and self-reported increased confidence with ambulation, floor to stand transfer, and ability to descend ramp safely at school.

Conclusion and significance

The outcomes of the case highlight the potential benefit of incorporating modified PSSE and breathing focused interventions to improve endurance and functional mobility in an individual with SMA III and AIS postoperatively.

Poster 23

EFFECT OF SEAS APPROACH ON FEMALE IDIOPATHIC SCOLIOSIS PATIENT IN 20S ON TRUNK APPEARANCE ASSESSMENT: A CASE REPORT

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Introduction

Idiopathic scoliosis is caused by a number of factors during rapid growth   a three-dimensional deformity of the spine and torso in the sagittal plane, horizontal plane, with a curve of more than 10° from the frontal plane. Patients with scoliosis have psychological problems with their appearance, and self-awareness of aesthetic appearance affects their quality of life. The first purpose of conservative treatment for scoliosis is improvement of asethetic, but there are currently few studies on asethetic changes after PSSE intervention.

Objective (s)

In female patient with idiopathic scoliosis in their 20s, we applied SEAS approach for 8 weeks to evaluate coronal balance (CI), Lennie test (LT), and TRACE in the sitting and sitting position with arms forward reaching to investigate changes in body appearance.

Study Design

This study was conducted as a single subject, and the study period was 8 weeks in total, with initial evaluation, 4 weeks later, and 3 times after 8 weeks, and the evaluation values of CI, LT, and TRACE were compared before and after

Methods

The subject of this study was a female in 20s, a professional health trainer, who complained of pain in both shoulders during bench press and was afraid to show her back with dissatisfaction due to scoliosis. she has lumbar cobb's angle 27 º, thoracic cobb's angle 24.5 º. Intervention was performed once a week for 2 hours and 8 weeks, and SEAS active self-correction was performed in a sitting position for the first 4 weeks. For active self correction, pelvic stabilization, right rotation of lumbar, and 10 o'clock shift of the 10th thoracic were performed. SEAS exercise was performed from 4 to 8 weeks. SEAS exercise was performed with the movement of the scapula and the arms forward reaching in a sitting position. Initial evaluation, 4 weeks later, and 8 weeks later, CI, LT, and TRACE were evaluated three times.

Results

Table 1. Total change value

		Initial		After 4 weeks		After 8 weeks	
		Sit	ARS	Sit	ARS	Sit	ARS
CI(mm)		22	24	5	5	0	0
LT(mm)	SA(Lt)	78	80	80	86	55	62
	SA(Rt)	80	80	68	78	49	57
	RS(Lt)	80	65	64	58	55	45
	RS(Rt)	80	72	72	75	50	52
	IA(Lt)	90	82	78	50	48	65
	IA(Rt)	75	56	83	78	45	65
TRACE(score)	SH	1	1	2	1	1	0
	SC	2	1.66	2	2	0	0
	HT	1	1	0	0	0	0
	WA	3	3	2	2	2	2

Sit: sitting position, ARS: arm reaching sitting, CI: coronal imbalance, LT: lennie test, SA: superior angle, Lt: left, Rt: right, RS: root of spine, IA: inferior angle, TRACE: trunk aesthetic clinical evaluation, SH: shoulder, SC: scapular, HT: hemi thorax, WA: waist

Conclusion and significance

After intervention of the SEAS approach in patients with idiopathic scoliosis in their 20s for 8 weeks, both the sitting position and arms forward reaching in sitting position were decreased to zero in coronal imbalance. In the Lennie test, left and right symmetrical values were obtained for both the sitting and arms forward reaching in sitting position in SA, RS, and IA. In TRACE, SH, SC, HT, and WA decreased in both the sitting position and arms forward reaching in sitting position, but the decrease was relatively small in WA.

Poster 24

SPORTS SPECIFIC SCOLIOSIS CORRECTION EXERCISE PROGRAM BASED ON SEAS APPROACH FOR ADOLESCENT IDIOPATHIC SCOLIOSIS PATIENTS PARTICIPATING IN SPORTS ACTIVITIES.

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Introduction

Sports are recommended for people with scoliosis. However, sometimes trunk imbalance may occur due to sports. Therefore, we need an exercise program that can provide 3D auto correction while participating in sports.

Objective (s)

Sports-specific scoliosis correction exercises program based on SEAS will have a positive impact on the radiological and clinical evaluation of patients.

Study Design

Case series

Methods

Target population: 14-year-old student who was first diagnosed with scoliosis in June 2022. The student is plays volleyball three times a week for two hours each time. She has NRS 4 pain in her left lower back. The right hand is the dominant hand. She have no experience wearing a scoliosis brace.

Interventions: Exercise program was conducted once a week for 90 minutes for a total of 10 weeks, and each session consisted of 20 minutes of active self correction, 40 minutes of stabilization exercises, and 30 minutes of sport-specific exercises. Sports specific exercises were made similar to movements frequently performed in sports played by the subject.

Assessment: Radiologically, Cobb's angle, sagittal Cobb's angle, and Raimondi angle were evaluated, and clinically, Coronal imbalance, Sagittal balance, Sagittal index, and Angle of trunk rotation were evaluated. Additionally, TRACE(Trunk aesthetic clinical evaluation) and NRS(Numeric rating scale) were evaluated.

Results

There was no significant difference in the radiological evaluation, but in the clinical evaluation, the coronal imbalance was 7mm before the intervention, but changed to 0mm after the intervention, and the angle of trunk rotation was 8 degrees at the waist before the intervention, but decreased to 6

degrees at the waist after the intervention. NRS decreased from 4 points before intervention to 0 points after intervention, and TRACE decreased from 6 points before intervention to 3 points after intervention.

Conclusion and significance

The sports specific scoliosis correction exercise program based on SEAS Approach is an exercise program that can reduce trunk imbalance while engaging in sports activities for patients with adolescent idiopathic scoliosis who participating in sports activities.

Poster 25

NON-SURGICAL REDUCTION IN FULL SPINE SAGITTAL BALANCE AND IMPROVED SENSORIMOTOR CONTROL IN AN OLDER ADULT WITH SPINAL DEFORMITY: A CBP® CASE REPORT

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Introduction

Forward sagittal balance is an adult spinal deformity (ASD) associated with poor clinical outcome as well as the risk of falling. Non-surgical approaches to reduce spinal deformities are evolving and one clinical goal is the reduction of sagittal vertical axis (SVA). Recent evidence has also emerged suggesting that functional performance tests are an important clinical correlate to disability in assessment of ASD. The clinical use of balance assessment in clinical practice has largely been subjective, however, the standard method of assessing standing balance is that of posturography, or the measurement of the center of pressure (COP) by use of a force plate. Advancements in technology now offer means to implement force plate assessment in clinical practice, and the documentation of improved sensorimotor control can be demonstrated resulting from effective treatment programs.

Objective (s)

To document the improvement in sensorimotor control, spinal deformity and chronic back pains by Chiropractic BioPhysics® (CBP®) technique methods.

Study Design

Case report.

Methods

A 78-year-old male presented with 20-years of chronic hip and lower back pain and stiffness. The pain was 5/10 and disability was 38% on the Oswestry low back pain questionnaire (ODI). The patient also complained of walking difficulty and balance problems that were contributed to a previously diagnosed right leg nerve entrapment, but denied any radiculopathy into the leg or foot. Radiographic assessment demonstrated a significant thoracolumbar kyphosis and anterior C2-S1 sagittal vertical axis (SVA). Force plate posturography showed high centre-of-pressure (COP) parameter values including the total path length, particularly for the vestibular condition of the modified clinical test of sensory integration and balance (mCTSIB). The patient was treated with 36 sessions of CBP corrective exercises and spinal traction as well as PowerPlate balance and gait exercises.

Results

Assessment after 4-months showed improvements in sleep, pain, disability, and mobility. There was an 86mm reduction in SVA and improved postural control in many parameters including a 49cm and 22cm reduction in COP total path length for the vestibular and visual trials on the mCTSIB. The pain was now 0/10 and ODI was 22%.

Conclusion and significance

This case demonstrates the significant improvement in postural control as quantified by the mCTSIB with the reduction of excessive SVA as demonstrated on post-treatment x-rays. These results are consistent with recent trials offering encouragement of the effects of posture correction on sensorimotor control in adult spinal deformity populations.

Poster 26

IMPROVED POSTURAL CONTROL IN A PATIENT HAVING ADULT SPINAL DEFORMITY AND PREVIOUS THORACO-LUMBAR SCOLIOSIS SURGERY: A CBP® CASE REPORT

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Introduction

There is evidence indicating patients with spinal deformity have impaired postural control and balance issues. Often, previous surgical intervention excludes the older patient from further invasive procedures leaving them with limited treatment options.

Objective (s)

The purpose of this case is to report on the dramatic improvement in postural control as measured by force plate after a multimodal treatment program of Chiropractic Biophysicsâ (CBPâ) posture rehabilitation as well as balance rehabilitation in an elderly patient with long-standing spinal deformity including thoracic hyperkyphosis and surgical instrumentation for thoracolumbar scoliosis.

Study Design

Case report.

Methods

A 69-year old female presented with the main complaint of balance and gait impairment as well as back pain and headaches. Balance assessment on a force plate showed impaired balance, in the vestibular challenging condition (eyed closed; standing on foam). Radiography showed a forward stooped posture and surgical hardware. Treatment was directed at posture by CBP methods and balance rehabilitation by a whole-body vibration exercise program. Treatment progressed over a 10-month period.

Results

The patient experienced relief of back pains and headaches. There was a significant improvement in posturography including a 102 cm reduction in center of pressure total path length. There was an inch reduction in forward sagittal stoop.

Conclusion and significance

A non-surgical rehabilitation program demonstrated significantly improved balance performance in an elderly female diagnosed with osteopenia, ASD and previous spine deformity surgery. This approach to improving postural stability is important and further investigations should be undertaken.

Poster 27

PATIENT DIGITAL TWIN AND PERFORMANCE CAPTURE SYSTEM FOR SCOLIOSIS PHYSIOTHERAPY

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Introduction

Physiotherapy Scoliosis Specific Exercises (PSSEs) have been proved effective for treating scoliosis patients with mild and moderate curves and beneficial for patients in bracing with moderate to severe curves and or in post-surgery rehabilitation. However, normal procedures and practices currently used in scoliosis physiotherapy treatment have several limitations: (a) The design of PSSEs may not be appropriate for an individual patient; (b) The instructions of PSSEs may not be clearly represented to or fully understood by a patient; and (c) PSSEs are not performed by a patient at home compliant to instructions and requirements. Due to these limitations, the effectiveness of PSSEs can be severely diminished.

Objective (s)

Develop a hardware-software integrated system, Ufit-Exercise, which provides a synthetic, immersive, and interactive environment for physiotherapists and patients to conduct PSSEs effectively.

Study Design

A concept of solution was developed first. Key technologies were then created, implemented, and tested. A prototype system was then constructed by integrating key technologies into a software system. The prototype system was tested and evaluated, and recommendations were made for future development.

Methods

Ufit-Exercise uniquely integrates cutting edge technologies of computer vision, extended reality, and serious games and leverages Innovision's proprietary human digital twin (HDT) technology. It comprises (a) Patient digital twin, which is a digital or virtual copy of the patient, describing body shape and muscular-skeletal structure of a patient and containing the diagnosis and other medical and health status information of the patient; (b) Performance capture system, which uses Microsoft Azure Kinect to capture body shape, to identify body pose, and to track body motion during exercise, and to allow the patient to interact with the system via voices; and (c) PSSE management system, which handles model creation, data acquisition and processing, computer vision, and performance evaluation.

Results

Core technologies for Ufit-Exercise have been created/ implemented, including patient digital twin, performance capture system, and performance monitoring and analysis algorithms. Ufit-Exercise prototype with basic functions has been created and evaluated for its feasibility and benefits.

Conclusion and significance

A hardware-software integrated system was developed for scoliosis physiotherapy, which provides a synthetic, immersive, and interactive environment for physiotherapists and patients to conduct PSSEs effectively. The significant benefits of this technology include (a) Enabling telehealth between a physiotherapist and a scoliosis patient by providing a synthetic, immersive environment; (b) Improving the accuracy and completeness of diagnosis and assessment through three-dimensional, dynamic analysis of patient situation using PDT and mocap data; (c) Facilitating effective patient communication and education in various illustrative and intuitive ways via PDT and serious games; (d) Ensuring patients to perform PSSEs according to instructions and compliance requirements under synthetic, immersive training environment; (e) Tracking exercises in real time and evaluating the performance and progress with quantitative metrics.

Poster 28

EFFECT OF AN INTERVENTION PROGRAM WITH SPECIFIC S4D EXERCISES THROUGH TRADITIONAL PHYSIOTHERAPY AND TELEREHABILITATION IN ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS

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Introduction

Telerehabilitation has become increasingly popular since the COVID-19 outbreak. However, studies are needed to understand the effects of remote delivery of treatment approaches.

Objective (s)

To verify and compare the effects of specific S4D exercises delivered online (telerehabilitation) or in-person on the progression of scoliotic curvature in adolescents with idiopathic scoliosis; to verify and compare the implementation outcomes of acceptability, appropriateness, and feasibility in both groups of adolescents and physiotherapists.

Study Design

This is a quasi-experimental retrospective study with an implementation perspective.

Methods

Sixty-six adolescents with idiopathic scoliosis were included. Recruitment was conducted through the Clinical Center in Scoliosis Care (January-December 2020). Participants were divided into two intervention groups: telerehabilitation specific dynamic S4D exercises (n=33) and traditional in-person specific dynamic S4D exercises (n=33). Both groups also received a thoracic-lumbar-sacral orthosis. Assessments were performed at baseline (T0) and after six months of the intervention protocol (T6). The Cobb angle was evaluated through radiographic examination. Implementation outcomes included acceptability, appropriateness, and feasibility of the intervention.

Results

There were no significant differences between groups: telerehabilitation and traditional in-person, for the Cobb angle of the main scoliotic curvature, with no changes in the Risser sign, thoracic and lumbar Cobb angles, and thoracic and lumbar Nash and Moe classification. The intervention was acceptable, appropriate, and feasible for participants and physiotherapists.

Conclusion and significance

Specific S4D exercises delivered via telerehabilitation or traditional in-person methods provided similar effects on the progression of scoliotic curvature in adolescents with idiopathic scoliosis.

Poster 29

MATERIAL SENSITIVITY OF PATIENT-SPECIFIC FINITE ELEMENT MODELS IN THE BRACE TREATMENT OF SCOLIOSIS

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Introduction

Brace treatment is an important non-surgical method for immature adolescent idiopathic scoliosis (AIS) patients with a mild or moderate curve. Patient's flexibility is closely associated with in-brace correction and treatment outcomes. Few studies had explored specific factors that influencing patient's flexibility.

Objective (s)

To study the mechanical sensitivity of different intervertebral disc and bone material parameters and ligaments under different force configurations and magnitudes in the scoliosis model.

Study Design

A finite element analysis.

Methods

The finite element model of a 21-year-old female is built using computed tomography. Local range of motion testing and global bending simulations are performed for the model verification. Subsequently, Five force of different directions and configurations were applied to the finite element model applying the brace pad position. The material parameters of the model were related to different spinal flexibilities and included different material parameters of cortical bone, cancellous bone, nucleus and annulus. The virtual X-ray technique measured Cobb angle, thoracic Lordosis, and lumbar Kyphosis.

Results

The difference in peak displacement is 9.28 mm, 19.99 mm, 27.06 mm, 43.99 mm, and 50.1 mm under five force configurations. The maximum Cobb angle difference due to material parameters are 4.7° and 6.2°, which are converted to thoracic and lumbar in-brace correction difference of 18% and 15.5%. The maximum difference in Kyphosis and Lordosis angle is 4.4° and 5.8°. The average thoracic and lumbar

Cobb angle variation difference in intervertebral disc control group is larger than that in bone control group, while the average Kyphosis and Lordosis angle is inverse. The displacement distribution of models with or without ligaments is similar, with a peak displacement difference of 1.3 mm in C5. The peak stress occurred at the junction of the cortical bone and ribs.

Conclusion and significance

Spinal flexibility largely influences the treatment effect of the brace. The intervertebral disc has a greater effect on the Cobb angle, the bone has a greater effect on the Kyphosis and Lordosis angles, and the rotation is affected by both. Patient-specific material is the key to increasing accuracy in the personalized finite element model. This study provides a scientific basis for using controllable brace treatment for scoliosis.

Poster 30

PREPARE: PERSONALIZED REHABILITATION VIA NOVEL AI PATIENT STRATIFICATION STRATEGIES - THE CASE FOR IDIOPATHIC SCOLIOSIS DURING GROWTH

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Introduction

Drafting an Individual Rehabilitation Project (IRP) entails setting goals based on functional prognosis. However, in rehabilitation, outcome prediction, with consequent patient stratification, is greatly hampered by various issues. The primary outcome is neither mortality nor morbidity but functioning. Furthermore, rehabilitation treatment is a complex, multimodal intervention delivered through a multidisciplinary approach. Idiopathic Scoliosis is a field of rehabilitation medicine with some specificities because it deals with the prevention of future disability in adulthood due to progression or spinal fusion.

Prediction models are needed to understand better the natural history of the disease and the determinants of the success of treatments. These models would allow us to tailor therapies better and avoid over- and under-treatment. Some predictors of treatment success are individually known, but they have rarely been combined in more complex models. Artificial Intelligence methods could allow new insights into these predictors.

Objective (s)

PREPARE Rehab aims to advance rehabilitation care by developing, validating, and implementing robust, clinically relevant, and data-driven computational prediction and stratification tools in nine health conditions, including Idiopathic Scoliosis.

Study Design

Machine learning (ML) techniques will be utilized on nine extensive patient datasets. A platform will be created to share model results, leveraging the open-science EHDEN platform and adopting the Observational Medical Outcomes Partnership (OMOP) Common Data Model (CDM) standard. The partners will develop prediction and stratification ML strategies, which will be validated through demonstration studies in nine health conditions.

Methods

We will exploit a tertiary care (for rehabilitation of children with scoliosis) facility's database. Data comprise demographics, disease characteristics, clinical reported outcomes and PROMs and are

collected electronically at baseline and every 4 to 6 months. Moreover, natural history information is available for all patients with previous X-rays without treatment.

Results

Data from 21026 patients (4588 males) with idiopathic scoliosis are being analyzed. Age was 12.6±2.6 years, Cobb angle 25.6±13.6°, Angle of Trunk Rotation 8.3±4.1°. A brace was prescribed to 9704 patients, and specific exercises to 7854 patients. The ISYQOL questionnaire of 6377 patients showed a score of 61.6±14.6%, and the SRS-22 of 9174 was 4.1±0.4.

Conclusion and significance

Exploiting the latest advances in clinical, socio-behavioural and public health research, data science, and advanced statistical and AI learning methods, PREPARE Rehab will pave the way to more personalized, reliable, and holistic rehabilitation and care, taking into account external circumstances and patient factors to improve quality of care and life for nine clinical cases, including idiopathic scoliosis during growth.

Final expected results are 1) A unified advanced decision-support platform for the management of big data and federated access to clinical data; 2) Novel patient stratification methods and prediction models enhanced by advanced ML/Artificial Intelligence (AI) tools; 3) Medical Device Regulation roadmap for any (software as a) medical device embedding.

Poster 31

INVESTIGATION OF THE EFFECT OF SPINAL ORTHOSIS ON THE SENSE OF TOUCH AND BALANCE IN INDIVIDUALS WITH ADOLESCENT IDIOPATHIC SCOLIOS WITH CURVATION IN THE LUMBAL REGION

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Introduction

Adolescent idiopathic scoliosis is a spinal deformity that occurs between the ages of 10-18 and whose conservative treatment is spinal orthosis. Although the effects of spinal orthosis on tactile sensation, dynamic balance and quality of life have been examined in the literature, there are no studies evaluating all of them together.

Objective (s)

The aim of the study is to investigatethe effect of short-term spinal orthosis use on the sense of touch, dynamic balance and quality of life in adolescent individuals.

Study Design

The study is a prospective cohort study because it investigates the effect of spinal orthosis. Pretest and posttest were used.

Methods

The study included 42 individuals, 27 girls and 15 boys, between the ages of 10 and 18, who had a curvature in the lumbar region and were diagnosed with AIS by a doctor. Semmes Weinstein Monofilament Kit containing five different thicknesses of monofilament was used for sensory evaluation of T12-L4-L5 points, Y-Balance test for dynamic balance, and SRS-22 questionnaire to evaluate quality of life. All evaluations were made before the use of any orthosis (pre-test) and 12 weeks after the use of a spinal orthosis (post-test).

While Paired Sample T test is used to compare the change over time in data that meet normal distribution criteria among variables; The McNemar test was used to compare change over time in categorical data.

Results

Comparison of monofilament T10 different direction results of individuals with AIS included in the study before and after spinal orthosis treatment			AIS (n=42)				P
			no		yes		
			n	%	n	%	
2.83	concave	Pre-test	42	100.0	0	0	-
		Post-test	42	100.0	0	0	
	convex	Pre-test	42	100.0	0	0	-
		Post-test	42	100.0	0	0	
3.61	concave	Pre-test	42	100.0	0	0	0.250
		Post-test	39	92.9	3	7.1	
	convex	Pre-test	42	100.0	0	0	0.000
		Post-test	26	61.9	16	38.1	
4.31	concave	Pre-test	30	71.4	12	28.6	0.012
		Post-test	21	50.0	21	50.0	
	convex	Pre-test	26	61.9	16	38.1	0.001
		Post-test	11	26.2	31	73.8	
4.56	concave	Pre-test	35	83.3	7	16.7	0.000
		Post-test	19	45.2	23	54.8	
	convex	Pre-test	23	54.8	19	45.2	0.012
		Post-test	12	28.6	30	71.4	
6.65	concave	Pre-test	0	0	42	100.0	-
		Post-test	0	0	42	100.0	
	convex	Pre-test	0	0	42	100.0	-
		Post-test	0	0	42	100.0	

AIS: Adolescent idiopathic scoliosis, McNemar test

Comparison of monofilament L4 different direction results of individuals with AIS included in the study before and after spinal orthosis treatment			AIS (n=42)				P
			no		yes		
			n	%	n	%	
2.83	concave	Pre-test	42	100.0	0	0	-
		Post-test	42	100.0	0	0	
	convex	Pre-test	42	100.0	0	0	-
		Post-test	42	100.0	0	0	
3.61	concave	Pre-test	42	100.0	0	0	0.500
		Post-test	40	95.2	2	4.8	
	convex	Pre-test	42	100.0	0	0	0.000
		Post-test	25	59.5	17	40.5	
4.31	concave	Pre-test	26	61.9	16	38.1	0.022
		Post-test	17	40.5	25	59.5	
	convex	Pre-test	16	38.1	26	61.9	0.143
		Post-test	9	21.4	33	78.6	
4.56	concave	Pre-test	33	78.6	9	21.4	0.000
		Post-test	13	31.0	29	69.0	
	convex	Pre-test	27	64.3	15	35.7	0.000
		Post-test	9	21.4	33	78.6	
6.65	concave	Pre-test	0	0	42	100.0	-
		Post-test	0	0	42	100.0	
	convex	Pre-test	0	0	42	100.0	-
		Post-test	0	0	42	100.0	

AIS: Adolescent idiopathic scoliosis, McNemar test

Comparison of monofilament L5 different direction results of individuals with AIS included in the study before and after spinal orthosis treatment			AIS (n=42)				P
			no		yes		
			n	%	n	%	
2.83	concave	Pre-test	42	100.0	0	0	-
		Post-test	42	100.0	0	0	
	convex	Pre-test	42	100.0	0	0	-
		Post-test	42	100.0	0	0	
3.61	concave	Pre-test	42	100.0	0	0	-
		Post-test	42	100.0	0	0	
	convex	Pre-test	42	100.0	0	0	0.000
		Post-test	30	71.4	12	28.6	
4.31	concave	Pre-test	23	54.8	19	45.2	0.143
		Post-test	16	38.1	26	61.9	
	convex	Pre-test	24	57.1	18	42.9	0.000
		Post-test	7	16.7	35	83.3	
4.56	concave	Pre-test	30	71.4	12	28.6	0.000
		Post-test	13	31.0	29	69.0	
	convex	Pre-test	30	71.4	12	28.6	0.000
		Post-test	7	16.7	35	83.3	
6.65	concave	Pre-test	0	0	42	100.0	-
		Post-test	0	0	42	100.0	
	convex	Pre-test	0	0	42	100.0	-
		Post-test	0	0	42	100.0	

AIS: Adolescent idiopathic scoliosis, McNemar test

Comparison of right foot dynamic balance subparameter results of individuals with AIS included in the study before and after spinal orthosis treatment		AIS (n=42)		t	P
		X	SS		
Anterior	Pre-test	53.86	12.41	-5.26	0.000
	Post-test	57.97	11.44		
Posterolateral	Pre-test	79.00	11.91	-3.32	0.002
	Post-test	82.55	12.69		
Posteromedial	Pre-test	74.12	15.61	-3.17	0.003
	Post-test	80.41	12.86		

AIS: Adolescent idiopathic scoliosis. Paired T test. X: mean. SD; Standard deviation

Comparison of SRS results of individuals with AIS included in the study before and after spinal orthosis treatment		AIS (n=42)		t	P
		X	SS		
SRS	Pre-test	59.79	11.67	-34.88	0.000
	Post-test	86.12	10.18		

AIS; Adolescent idiopathic scoliosis. Paired T test. X: mean. SD; Standard deviation

Comparison of left foot dynamic balance subparameter results of individuals with AIS included in the study before and after spinal orthosis treatment		AIS (n=42)		t	P
		X	SS		
Anterior	Pre-test	49.87	12.83	-4.49	0.000
	Post-test	54.83	12.58		
Posterolateral	Pre-test	79.61	11.43	-1.16	0.251
	Post-test	81.15	12.79		
Posteromedial	Pre-test	75.68	13.82	-4.79	0.000
	Post-test	81.69	11.64		

AIS; Adolescent idiopathic scoliosis. Paired T test. X: mean. SD; Standard deviation

In the pre-test-post-test sensory evaluation with monofilament; For the T10 region, it was 3.61 points on the convex side (p=0.000), 4.31 points on the convex and concave sides (p=0.001; p=0.012, respectively), and 4.56 points (p==0.013; p=0.000, respectively); For the L4 region, it was 3.61 on the convex side (p=0.000), 4.31 on the concave side (p=0.022), and 4.56 on the convex and concave sides (p=0.000; p=0.00, respectively); For the L5 region, it was 3.61 points (p=0.000) and 4.31 points (p=0.000) on the convex side, and at the 4.56 point end (p= 0.000; p=0.000, respectively) on the convex and concave side a statistically significant difference was observed, no differences were observed in other monofilament measurement areas. Pretest-posttest dynamic balance right foot parameter in anterior, posterolateral and posteromedial directions (p=0.000; p=0.002; p=0.003, respectively); in the left foot parameter in the anterior and posteromedial directions (p=0.000; p=0.000, respectively) and in the quality of life survey results (p=0.000) a statistically significant difference was observed.

Conclusion and significance

As a result of the tactile evaluation, it was observed that there was body awareness and sensitivity in the lumbar region due to the use of a spinal orthosis. Dynamic balance and quality of life improved following the use of a spinal orthosis. From these results, we can think that as individuals adapt to the spinal orthosis, their awareness increases and their balance is positively affected.

Poster 32

A MULTIMODAL NON-SURGICAL APPROACH TO SEVERE ADOLESCENT IDIOPATHIC SCOLIOSIS: A CASE SERIES

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Introduction

Contrary to some beliefs, recent studies have reported successful outcomes with brace treatment in patients with moderate-severe scoliosis ≥40° who refuse surgery. Adolescents with idiopathic scoliosis (AIS) with curves at or beyond surgical indication (≥45-50°) may wish to explore non-surgical treatment options.

Objective (s)

To report the outcomes of a multimodal approach to treat 5 AIS, with curves at or beyond surgical threshold, who refused surgery.

Study Design

Case Series

Methods

A multimodal treatment approach: 21 hours/day with a ScoliBrace (SB), intensive manual therapy, CLEAR exercises, ScoliBalance (SBE), and daily home exercises (1h/day). Treatment lasted 37.4 months (average), with follow-up every 6 months. Patients were weaned from treatment when curves stabilised or improved.

Results

Initial in-brace Cobb angle reduced by 72% (average). All 5 AIS were successfully reduced to nonsurgical levels utilising a multimodal approach over 37.4 months (average). Initial Cobb angle reduced from 53° to 29°(average) after being weaned off treatment. Trunk Aesthetic Clinical Evaluation (TRACE) scores of each patient also improved.

Conclusion and significance

This multimodal approach for AIS with surgical level curves resulted in a reduced Cobb angle and large improvements in TRACE scores. This type of treatment approach may provide an alternative if surgery is not accepted by AIS. AIS who refuse surgery may wish to try non-surgical options.

Poster 33

CASE SERIES REPORT OF ATYPICAL LUMBAR SCHEUERMANN'S DISEASE TREATED WITH BRACES AND PHYSIOTHERAPEUTIC SPECIFIC EXERCISES

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Introduction

In adolescents, the prevalence of Scheuermann's Disease (SCHD) varies from 0.4% to 10%, while there are no studies about the precise prevalence of Atypical Lumbar type SCHD (ALSD). ALSD could cause back pain, poor posture, stiffness increase, and reduced flexibility. The gap of knowledge about ALSD could be explained by the high percentage of not diagnosed or misdiagnosed cases.

Objective (s)

This study aims to retrospectively review all the patients with exclusive ALSD in treatment in our Institute to analyse their clinical characteristics, describe the treatments performed, related results and their determinants in terms of pain and vertebral deformation.

Study Design

Case series report

Methods

We searched our electronic clinical charts and included all children under age 18 prospectively diagnosed with ALSD. Our Institute is a tertiary outpatient facility specialized in spinal disorders conservative treatment during growth. According to the treatment, we divided participants into two groups: subjects who performed specific stabilization exercises only, and participants who wore a full-time (20 to 23 hours/day) Lapadula monovalve lordotizing brace (always with stabilization exercises). Due to the scarce knowledge about treatment efficacy, choices for bracing or exercises were driven mostly by physicians' expertise and patients' values in a shared decision making process. We collected clinical (*SRS-22 questionnaire, lumbar and thoracic stiffness, angle of trunk rotation degrees, height of the hump, scoliosis and hyperkyphosis stiffness, neurological signs,*) and x-ray data (*European Risser sign, spinal curvatures magnitude, kyphosis and lordosis Cobb angle, wedging angle of vertebrae with Scheuermann's Disease*). We considered the end of treatment according to prescription or achievement of European Risser 3 sign. To evaluate treatment effectiveness, all measurements were taken before and after treatment, with treatment conclusion defined as no estimated further risk of progression.

Results

Out of 11891 children, 435 had SCHD (3.6% - 56.3% males), of which 47 (10.8%) had ALSD (55.3% males). 50% ALSD presented with pain (SRS scale: 3.2±0.5, function 3.9±0.4) since an average of 7.2±2.7 months. Twelve (7 males, age 13±2) completed 30±25 months of treatment (5 still in treatment, 16 second opinion, 8 dropout, 6 incomplete radiographs): 7 exercises, 5 bracing. At start, braced patients had more SCHD vertebrae (3 with 7.4° wedging vs 2 and 7.7°, respectively). At 6 months follow-up we observed pain resolution (average 3.8±0.2) apart 1 braced and 2 exercises needing 12 months. Pain recurrences: none in bracing, 3 in exercises. On average, in brace the wedging angle reduced by 3° (range 3-10°) and progressed 1.6° (8-12°) in the exercises group. The figure shows the brace and SCHD vertebrae improvement in one patient after 12 months of treatment.

Conclusion and significance

Bracing and exercises can effectively treat pain due to ALSD. Contrarily to exercises, brace treatment improves lumbar vertebral body growth and pain control.

Poster 34

SUCCESSFUL TREATMENT OF DEGENERATIVE ADULT SCOLIOSIS USING A UNIQUE 3D OVER-CORRECTIVE BRACE - A CASE REPORT WITH 6 YEAR FOLLOW UP

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Introduction

Degenerative (de novo) scoliosis is a progressive condition commonly associated with chronic back pain (CLBP) and reduced quality of life. Conservative measures may be helpful for older adults suffering from this condition, possibly reducing the need for surgical intervention and providing improved quality of life.

Objective (s)

We present a case with a 6 year long term follow-up highlighting the successful management of an adult with degenerative scoliosis using a novel lumbosacral orthosis and multimodal conservative treatment.

Study Design

This is a long term case study from a patient who presented for care at a private practice facility. Objective findings and outcomes include x-rays, posture photos, 3d posture scans and quality of life questionnaires and patient reported outcome measurements.

Methods

We prescribed a custom 3-dimensional, over-corrective, rigid, lumbosacral orthosis [LSO] (ScoliBrace). ScoliBrace differs from traditional braces in that it uses postural re-positioning to harness spinal coupling to improve alignment, rather than 3-point pressure. We also prescribed multi-modal chiropractic treatment including daily mirror-image exercises and a traction fulcrum bending orthosis (ScoliRoll). Initially she received 12 treatments including home exercise/rehabilitation for four months. This patient has been followed for 6 years.

Results

Back pain levels reduced from 6/10 to 2/10. In-brace x-rays one month after brace fitting revealed decreased scoliosis from 43 degrees Cobb to 34 degrees.
Four months after brace fitting wear time was 18-23 hours per day. The lower extremity symptoms were alleviated up to 4 hours after taking off the brace. Out-of-brace x-ray revealed that improvements observed on the in-brace x-ray had been maintained.

5 year follow up x-ray was obtained after being out of the brace overnight. The Cobb angle was stable at 32 degrees. She reported maintaining 2/10 back pain levels less than 25% of the day with no lower

extremity symptoms. She continued using traction-fulcrum bending orthosis (ScoliRoll) and wears her brace 6 to 18 hours per day. 6 years after initial bracing, she receives supportive chiropractic care an average of once or twice per month. Home exercises continue.

Conclusion and significance

This case demonstrates the successful long-term management of a patient with degenerative scoliosis using a ScoliBrace LSO combined with manual therapy and exercise/rehabilitation. This type of therapy is non-invasive, carries a lower risk profile, and is relatively inexpensive when compared with surgical intervention. Higher level research is required to determine the suitability of this type of therapy for patients with degenerative scoliosis.

Poster 35

ENHANCING SCOLIOSIS BRACING: INVESTIGATING THE IMPACT OF IN-BRACE CORRECTION EXCEEDING 100% ON SKELETAL OUTCOMES, COMFORT, AND COMPLIANCE

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Introduction

In-brace correction (IBC) is a key prognostic factor for successful bracing outcomes, with higher IBC correlating with improved skeletal alignment out of brace. The duration of brace wear also influences outcomes, showing a dose-effect response. This underscores the importance of ensuring comfort for consistent use of scoliosis braces. While the industry standard accepts 50% IBC, recent advancements in assessment, algorithmic techniques, and brace design have allowed for significantly greater IBC, surpassing 100%. To our knowledge, there is no consensus documenting IBC that exceeds 100% - the impact on skeletal outcomes and the self-reported comfort and compliance associated with it.

Objective (s)

This study aims to document the effects of IBC exceeding 100% on follow-up out-of-brace skeletal outcomes. Additionally, it seeks to retrospectively assess self-reported brace comfort and compliance levels during the first week, month, and full-time brace usage.

Study Design

Preliminary retrospective study.

Methods

We screened our dataset for patients with IBC exceeding 100%, focusing on those who completed one brace cycle and who had a secondary out-of-brace x-ray. Cobb angles were evaluated, and patients anonymously self-reported brace comfort (using VAS scale) and compliance. The study included data from 8 patients.

Results

The mean age at bracing commencement was 10.2 years, with a mean cobb angle at assessment of 33.4°, correcting to -10.5° in-brace, indicating a mean in-brace correction of 134%. After the first bracing round, every out-of-brace x-ray demonstrated true skeletal correction, with a mean cobb angle of 17.5°. Full-time bracing (22 hours) was achieved within the first week by 4 out of 8 patients. The remaining 4 reported compliance to be at 75% during the first week. Six patients reached full-time use within the first month. The remaining 2 reported they were at 75% and 90% compliance, respectively. Seven of the

8 patients reported 100% overall compliance throughout bracing treatment. The remaining 1 patient reported her compliance to be at 75% throughout treatment. The VAS scores indicated decreasing discomfort over time - starting with a mean of 4.5 during the first week, 3.6 during the first month, and a mean score of 1.6 throughout overall treatment.

Conclusion and significance

While achieving high levels of IBC may not be feasible for every patient, our results suggest it can lead to significant improvements in skeletal alignment and scoliotic correction. Well-designed braces with very high IBC can ensure patient comfort and high compliance. This study encourages orthotists to explore over-corrective bracing designs to push traditional standards and enhance patient outcomes in scoliosis management - ensuring maximum comfort for patients, subsequently improving compliance and skeletal correction.

Poster 36

COMBINING 3D DESIGN WITH THE CERVICAL THORACIC ORTHOSIS (CTO) IN THE TREATMENT OF ANTECOLLIS AND PISA SYNDROME IN PARKINSON DISEASE: A CASE REPORT

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Introduction

 Antecollis and Pisa syndrome (PS) are disabling postural deformities characterized by marked neck flexion (>45°) and lateral trunk deviation (≥10°). The pharmacological and surgical treatment remains challenging. Spinal orthoses, may be useful treatments to preserve motion, slow progression, and prevent complications of progressive spinal deformities.

The spinal orthosis has rarely been used in dystonia due to the complexity and challenges in applying force that is appropriate to correct the spinal misalignment. Overapplying the force can potentially hinder movements or aggravate dystonia. There is limited evidence of orthotic use in dystonia, and only a few reports of its use in either dropped head syndrome or dystonic antecollis.

Conversely, spinal orthosis is commonly used in structural scoliosis. However, designing orthoses for antecollis and PS due to PD is complicated by dynamic variations in spinal angles throughout the day, unlike the more stable angles in idiopathic scoliosis. Because the alignment needs to be dynamic, excessive corrective force may restrict movement or aggravate pain and discomfort, and increase dystonia. For example, two studies of spinal orthosis to treat camptocormia revealed that the most common cause of poor compliance was pain or discomfort.

Objective (s)

To demonstrate the efficacy of orthosis in antecollis and Pisa syndrome (PS) in Parkinson disease.

Study Design

Case report with time series.

Methods

A 61-year-old man with PD had antecollis and PS for 5 years. Antecollis did not respond well to botulinum toxin injections and levodopa. The neck flexion was not different between OFF- and ON-medication states, while the lateral truncal deviation angle was partially responded during the ON-medication state. The CTO was designed as an easily adjustable orthosis to find the optimum correction while maintaining regular movements in daily living.

The adjustment was carefully performed to balance proper alignment and the patient's comfort. The neck flexion and lateral truncal deviation angles were measured during walking by 2D motion analysis software from video recording, immediately after the orthosis application and again after 5 months.

On the follow-up date, he could use the orthosis without complications. However, he encountered issues wearing the CTO at the workplace due to the bulky appearance and increase sweating over the head and face, limiting his work. Consequently, we created the 3D print of cervical part with ventilation to address this issue.

Results

The cervical thoracic orthosis(CTO) during walking at home

Model of 3D cervical part

Replaced the cervical part with 3D printed to be more light weight and more ventilated.

With the CTO application, the immediate neck flexion was reduced from 72 to 30 and 88 to 34 degrees after 5 months. The lateral truncal deviation was decreased from 30 to 14 degrees with similar improvement between immediate and after 5 months. The 3D application could enhance comfort and compliance while maintaining the same efficacy. He reported no complications such as pain or limited motion.

Conclusion and significance

Adjustable CTO could reduce abnormal angles in antecollis and PS in Parkinson disease.

Poster 37

3D-PRINTED SPINAL ORTHOSIS FOR ADOLESCENT IDIOPATHIC SCOLIOSIS (AIS) IN A LOW-TO-MIDDLE-INCOME COUNTRY; CASE REPORT.

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Introduction

Spinal orthosis is one of the conservative treatment for idiopathic scoliosis. Compliance, wearing the orthosis 23 hours per day is recommended to get an ultimate outcomes. However, wearing conventional orthoses in hot climates, such as Thailand, can be challenging during the daytime. Additionally, some patients face bullying at school due to the bulky appearance of these orthoses. The integration of 3D technology has the potential to address these issues. However, the cost of commercial Computer-Aided Design/Computer-Aided Manufacturing (CAD/CAM) systems for spinal orthosis is too expensive for our setting, where health insurance in Thailand covers 235 USD per brace. To overcome this financial barrier, we developed a cost-effective Hybrid technique to reduce the expenses associated with purchasing the software.

Objective (s)

Study the efficacy of spinal orthosis by integrating 3D technology with the conventional method (Hybrid Technique) in Adolescent Idiopathic Scoliosis (AIS) patient.

Study Design

Case report

Methods

The orthosis was made by using hybrid method to adjust and correct the spinal alignment. Initially, a plaster cast was molded around the patient, employing a modified Cheneau brace concept to ensure proper alignment. Through this method, we were able to save on the cost of purchasing commercial CAD-CAM for spinal orthosis. The precision and accuracy were validated by the conventional method during plaster molding. Subsequently, a 3D iPad scanner was utilized to scan the molded cast, and a free CAD-CAM software program was employed to design the spinal brace for 3D printing. The 3D-printed orthosis was constructed using nylon filament, and the design prioritized ventilation and thinness while maintaining effective biomechanical correction. The brace was thin enough to remain hidden under clothing when worn.

Results

Cobb 32 degree, 2021

Without brace Cobb reduced to 18 in 2022

With brace Cobb at 10 degrees,

A 14-year-old girl with scoliosis had a Cobb angle (apex T10) of 20 degrees four years ago. The conventional brace successfully reduced the angle to 15 degrees. However, she could not wear the brace at school due to bullying by her friends and the hot weather, leading to poor compliance. As a result, the Cobb angle progressed to 32 degrees within one year.

Our 3D spinal orthosis could reduce the angle to 18 degrees with excellent compliance. After one year, the cobb angle could be reduced to 10 degrees. She continued using the brace until the age of 16, by which time her bones had matured, and the final angle measured less than 10 degrees at the end of the treatment. The patient gave positive feedback of comfort and confidence.

Conclusion and significance

The hybrid method has proven to be an effective approach for creating 3D spinal orthoses for AIS patient. By integrating traditional molding techniques with advanced 3D technology, we have successfully addressed issues such as cost, comfort, and treatment adherence.

Poster 38

EARLY WEANING OF THE 3D BRACE IN A PATIENT WITH JUVENILE IDIOPATHIC SCOLIOSIS DURING 5 YEARS OF TREATMENT – A CASE STUDY

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Introduction

Juvenile Idiopathic Scoliosis (JIS) is characterized by a higher risk of progression compared to Adolescent Idiopathic Scoliosis (AIS). To avoid curve progression and enhancing aesthetic and quality-of-life improvements are shared objectives of the Scientific Exercises Approach to Scoliosis (SEAS) and the 3D brace based on Rigo-Chêneau principles.

Objective (s)

This case report aims to present preliminary outcomes of five years of conservative treatment using the SEAS approach and Rigo-Chêneau brace with early brace weaning in a patient with JIS.

Study Design

Case report study.

Methods

In 2018, a 6-year-old girl diagnosed with JIS underwent evaluation by a multidisciplinary team comprising a physiotherapist, surgeon, and physiatrist/orthotist. The angle of trunk rotation (ATR) and Cobb angle were assessed. Weekly sessions, conducted in a playful manner, spanned 64 months of treatment (51 months of SEAS and 3D brace). In 2020 and 2021, sessions adopted a hybrid format (teleconsultation and in-person) occurring twice monthly. Thirteen evaluations were performed, with nine clinical assessments accompanied by out-of-brace X-ray and four in-brace X-rays (Tables 1 and 2). After 9 months of SEAS treatment, clinical and radiographic progression led to introducing full-time bracing (23 hours/day) and increased session frequency to twice a week for 10 months. Following a year of clinical and radiographic stability, with the primary curve reduced to an angular value below 25°, brace weaning commenced in June 2022, gradually reducing usage hours until complete removal in June 2023.

Results

At the end of the studied period, 4 months post-complete brace weaning, no curve progression was observed. A reversal occurred in the lumbar curve (31° left to 13° right) and thoracic curve (27° right to 14° left). Clinical assessment also revealed reversal in ATR in the lumbar (9° left to 3° right) and thoracic (5° right to 5° left) regions (Table 1). In-brace X-rays were taken at each brace change, totaling 4

radiographs (Table 2). Curve correction varied from 52% in the first brace to a hypercorrection of 60% in the lumbar region with a reversal in curve direction.

Table 1. Out-of-brace measurements and clinical assessments.

Measurements	2018	2019	2020/1	2020/2	2021	2022/1	2022/2	2023/1	2023/2
Lumbar Cobb angle	23°	31°	31°	21°	0°	0°	12°*	8°*	13°*
Thoracic Cobb angle	16°	16°	27°	20°	8°	4°	15°*	14°*	14°*
Lumbar ATR	5°	9°	5°	2°	10°*	7°*	5°*	5°*	3°*
Thoracic ATR	2°	5°	5°	4°	5°	3°	5°*	5°*	5°*

* Indicates reversal of the side measured.

Table2. In-brace X-rays measurements.

In-brace X-rays	2019	2020/1	2020/2	2022
Lumbar Cobb angle	15°	7°	7°	6°*
Thoracic Cobb angle	16°	11°	4°	14°*

* Indicates reversal of the side measured.

Conclusion and significance

Preliminary results of treatment using the SEAS approach and the Rigo-Chêneau brace combined with early brace weaning in this JIS patient showed curve stability and a tendency toward reversal. The patient will continue to be monitored by the multidisciplinary team until skeletal maturity. Post-growth completion will allow for definitive presentation of treatment outcomes.

Poster 39

HOW WILL I SEE MY BODY AFTER SURGERY? - COMPARISON OF THE TRUNK APPEARANCE PERCEPTION SCALE BEFORE AND AFTER SURGICAL TREATMENT OF ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS

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Introduction

Adolescents with idiopathic scoliosis (IS) commonly experience concerns regarding their body appearance. To assess their perception of trunk deformity, the Trunk Appearance Perception Scale (TAPS) is used as a self-evaluation tool.

Objective (s)

This study aims to assess the immediate effect of surgical treatment on the perception of body deformity in adolescents with IS using the TAPS.

Study Design

A retrospective study of prospectively collected data.

Methods

The study included 37 patients with IS (33 girls, 4 boys), aged 12-18 who completed the TAPS questionnaire 1-2 days before and 6-7 days after surgical correction of idiopathic scoliosis.

Results

The mean postoperative Cobb angle values in both the thoracic and the lumbar curvature were significantly lower compared to the preoperative values (thoracic 24.8°±11.9 vs. 58.3°±16.3, $p<0.001$; lumbar 16.1°±9.9 vs. 43.3°±11.4, $p<0.001$). The percentage of correction was 57.02%±17.43 and 63.76%±18.62, for the thoracic and the lumbar curvature, respectively. The TAPS score decreased from 3 preoperatively to 1 postoperatively (the mode of the score) concerning the posterior and the bending forward view, while it decreased from 3 to 2 for the anterior view. There was a significant difference between pre-and postoperative TAPS scores ($p<0.001$). However, no relation was found between the surgical curve correction in degrees or percentages versus the postoperative TAPS score for the anterior, posterior, or forward bending view ($p>0.05$).

Conclusion and significance

The short-term cosmetic effect of surgical IS treatment improves patients' perception of trunk deformity, regardless of the degree of Cobb angle correction.

Poster 40

PHYSIOTHERAPEUTIC SCOLIOSIS SPECIFIC EXERCISE AND BRACING FOR SECONDARY CURVE AFTER LUMBAR VERTEBRAL BODY TETHERING: A CASE REPORT

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Introduction

Introduction: Anterior vertebral body tethering is an increasingly utilized method for individuals with high risk adolescent idiopathic scoliosis (AIS) who are skeletally immature and wish to preserve spinal mobility1. A combined posterior spinal fusion in the thoracic and anterior vertebral body tethering in the lumbar region has been proven safe and effective for individuals with double curves and concern regarding maintaining lumbar mobility.2 To date, no literature has examined the potential benefit of conservative management including postoperative bracing and physiotherapeutic scoliosis specific exercise (PSSE) as an alternative to thoracic posterior spinal fusion to manage the secondary thoracic curve following lumbar vertebral body tethering.

Objective (s)

Objective: To demonstrate the potential benefits of postoperative PSSE and bracing on management of secondary thoracic curve as an alternative to posterior spinal fusion subsequent to lumbar vertebral body tethering.

Study Design

Study Design: Case Report

Methods

Methods: Patient is a 12 year old pre-professional ballerina who presented to Columbia University Medical Center and received initial diagnosis of AIS. On evaluation, surgical intervention was recommended as patient is skeletally immature (Sanders 3) with classified severe curves (Cobb angle: 32 degree left upper thoracic, 52 degree right thoracic, 64 degree lumbar). Due to the patient being a pre-professional ballerina preserving mobility and avoiding a spinal fusion was crucial to the patient and family. Patient underwent lumbar anterior vertebral body tethering (AVBT), was to brace for 18 hours a day and complete a course of scoliosis specific physical therapy postoperatively. Status post lumbar AVBT patient wore a Cheneau Type brace which is a Detorsional, Three-dimensional, Monocot construction,ventral opening brace with 52% in brace correction of the thoracic non instrumented curve noted on radiograph. Patient completed 28 sessions of physical therapy (PSSE, lumbo-pelvic stabilization, functional optimization) over 1 year. Cobb angle was assessed at post operative follow up visits (5 month, 1 year).

Results

Results: Patient demonstrated improvement in cobb angle at 5 month (Sanders 5) and 1 year (Sanders 6) follow up. Radiographs demonstrated stabilization of left upper thoracic at 32 degrees, right main thoracic reduced by 27 degrees (52 to 25 degrees, 5 month) and 30 degrees (52 to 22 degrees, 1 year), and left lumbar reduced by 42 degrees (64 to 22 degrees, 5 month) and 46 degrees (64 to 18 degrees, 1 year).

Conclusion and significance

Conclusion: PSSE and bracing led to objective improvements on compensatory thoracic curve post lumbar tethering. This demonstrates that conservative management post lumbar AVBT may be an alternative approach to posterior thoracic spinal fusion for individuals with high risk double curve AIS with mobility concerns.

Poster 41

IMAGING STUDY OF COCCYGEAL MORPHOLOGY IN ADOLESCENT IDIOPATHIC SCOLIOSIS

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Introduction

Some studies on alterations of cervical, thoracic and lumbar spine in AIS patients have been reported previously. However, as the farthest part of the spine, the coccygeal morphology made up of multiple segments in AIS patients has not been reported yet.

Objective (s)

To observe the coccygeal morphology in adolescent idiopathic scoliosis (AIS) and the differences among different types of scoliosis.

Study Design

A retrospective analysis was performed on 268 patients who received full-length anteroposterior and lateral spine radiographs in the third affiliated hospital of Zhejiang Chinese Medical University from January 2018 to December 2022.

Methods

 All cases were divided into normal group with 135 cases and AIS group with 133 cases. Postacchini coccygeal radiological classification method modified by Nathan was used to observe and compare the sagittal plane coccygeal morphology in the two groups. The correlations between coccygeal morphology in sagittal plane and gender, scoliosis severity, scoliotic segments were analyzed too.

Results

There were the highest percentage (50.4%) of Type I and the lowest (5.2%) proportion of Type V in normal group and the highest percentage (33.1%) of Type I and the lowest (2.2%) proportion of Type V in AIS group. The difference in coccygeal morphology was significant between normal group and AIS group (P=0.006). There were no significant differences in coccygeal morphology between mild and moderate scoliosis (P=0.489), between male and female (P=0.812 in normal group, P=0.287 in AIS group), or among thoracic, thoracolumbar and lumbar scoliosis (P=0.129). There was a significant correlation between coccygeal morphology and scoliosis (P=0.049).

Conclusion and significance

Coccygeal morphology in mild and moderate AIS patients is significantly different from that in normal adolescents. The proportion of coccygeal type I is significantly higher in normal children than in AIS patients, while the proportion of coccygeal type II and type III is significantly lower in normal children. There were some differences in coccygeal morphology between mild and moderate scoliosis, and among different segmental scoliosis, but they were not significant. There was a significant correlation between coccygeal morphology and scoliosis, but the correlations between coccygeal morphology and gender, scoliosis severity, scoliotic segments were non-significant.

Poster 42

STRATIFIED PREDICTIVE MODELING FOR PROGRESSION OF IDIOPATHIC SCOLIOSIS

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Introduction

Surface topography (ST) has seen increasing popularity to reduce radiation exposure in the evaluation of 3D spine deformity in idiopathic scoliosis (IS). ST uses anatomic landmarks of the spine and contours of the back to create software generated spine models.

Objective (s)

To develop a mathematic predictive model that is able to stratify IS progression risk based on radiation free surface topographic metrics.

Study Design

Retrospective Case Series

Methods

Approved by Children's Wisconsin IRB committee. Inclusion criteria consisted of patients 8-18-years-old with known diagnoses with IS or spinal asymmetry. Radiographic imaging was collected using EOS Radiographs imaging system. 3D spine models were reconstructed using sterEOS software. ST was evaluated by DIERS formetric 4D and analyzed by software. A linear mixed effect model was fitted to relate some demographic and ST variables including age, gender, axial surface rotation (ASR) from T1 to L5, scoliotic angle, pelvis surface rotation to Cobb angle. Patients were stratified into three categories based on the difference of their Cobb angles between initial evaluation and most recent radiographic follow up visit in terms of Scoliosis Research Society's criteria: Progression ≤ -6°; Stable -5° to 5°; Improving: ≥ 6°. Using proportional odds logistic modeling and variable selection by Akaike information criterion (AIC) the probability of a patient's future curve progression was determined. P value <0.05 was considered statistically significant.

Results

38 children met inclusion criteria. Average age was 13.82 (SD=1.61) with 27 (71.05%) females. Average follow up was 34.87 months (SD=24.72) for radiographs and 15.47 months (SD=16.80) for ST. After AIC variable selection to stratify patients into Progression, Stable, or Improving, six predictors were included in the measure: Age and ASR at T8, T9, T10, L3, and L4 during the initial visit were included. Based on variable selection,

$$\log\left(\Pr(\text{Progression})/(1-\Pr(\text{Progression}))\right)=-12.00+0.75 Age-1.25 T8+2.77 T9-1.74 T10+0.72 L3-1.19 L4$$

$$\log\left(\Pr(\text{Progressing or Stable})/(1-\Pr(\text{Progressing or Stable}))\right)=-8.35+0.75 Age-1.25 T8+2.77 T9-1.74 T10+0.72 L3-1.19 L4$$

were constructed. Pr(Progression) is the probability that a patient belongs to the progressing group, Pr(Progression or Stable) is the probability that a patient belongs to the Progression group or the Stable group.

Progression: $Y1= (\exp(-12.00+0.75 Age-1.25 T8+2.77 T9-1.74 T10+0.72 L3-1.19 L4))/(1+\exp(-12.00+0.75 Age-1.25 T8+2.77 T9-1.74 T10+0.72 L3-1.19 L4))$,

Improving: $Y3=1/(1+\exp(-8.35+0.75 Age-1.25 T8+2.77 T9-1.74 T10+0.72 L3-1.19 L4))$

Stable: $Y2=1-Y1-Y3$.

Where Y1, Y2 and Y3 are the predicted probabilities of the Progression, Stable and Improving groups, respectively. Thus, based on this the patient would be assigned to the group in which they have the highest predicted probability (Table 1).

Conclusion and significance

This demonstrates the potential for the creation of a radiation free risk stratification model for the evaluation of IS correctly classifying 27/38 (71%) of patients. The Improving group accurately predicted 45% of the time with the remaining being classified as Stable. Thus, the overall performance of the model is stronger for those with Stable and Progressing curves and hindered by the Improving category classification.

Poster 43

LESSONS LEARNED ON TRUNK NEUROPHYSIOLOGY AND MOTOR CONTROL FROM ADOLESCENT IDIOPATHIC SCOLIOSIS. A SCOPING REVIEW

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Introduction

Compared to other joint complexes, the spine faces specific challenges due to the need to not only allow movement and stability (weight support) but also protect the only not-replaceable cells, the neurons (in the spinal cord). Neurophysiology is the critical control of this complexity, and its failure could contribute to some spinal disorders, like Adolescent Idiopathic Scoliosis (AIS). Many different exercise types have shown some efficacy in AIS, having in common only what all exercises do: changing the spinal neurophysiological control. Hence, a better understanding of spine neurophysiology could lead to the development of improved rehabilitation treatments.

Objective (s)

To synthesize the current evidence and identify interesting insights on spinal neurophysiological control.

Study Design

Scoping review.

Methods

We searched systematically four databases including English primary peer-reviewed studies that explored trunk motor control with any neurophysiological assessment method in AIS, published until June 2022. We collected all relevant information concerning study design and methodology, author and publication details, study participants, outcomes, and assessment measures.

Results

We screened 18,020 reports for title and abstract and 265 for full-text. Finally, we included 73 studies. The mean year of publication was 2006 (standard deviation [SD]=13.0; range=1961-2022). Study designs used were: cross-sectional (64%), prospective cohort (34%) and case-control (2%). A total of 2712 AIS patients and 911 healthy controls were included and the most used neurophysiological assessment techniques were: electromyography (EMG; 59%), evoked potentials (21%), electroencephalography (4%) and magnetic resonance imaging (MRI; 4%). Overall, we found that adolescents with IS have altered vertical perception and asymmetrical trunk muscle activities that can compromise postural control

together with other sensorimotor or vestibular deficits. Conflicting results are available about the link between trunk muscle control and curve etiology and progression. Finally, we found a reduction with the years of scientific interest in research on the neurophysiological spinal control in AIS.

Conclusion and significance

Modern techniques like advanced MRI, HD-EMG, or functional near-infrared spectroscopy could have an important impact on understanding AIS neuromotor control. As it happened for rehabilitation and exercises for the limbs, this would probably impact our therapeutic strategies for the trunk. These results support the need for increasing primary research in the field. Increased neurophysiological research and understanding would help practitioners in identifying possible new improved rehabilitation and exercise approaches.

Poster 44

RELIABILITY OF THE BIOMECHANICAL ASSESSMENT OF THE SAGITTAL THORACIC SPINE ON RADIOGRAPHS USED IN CLINICAL PRACTICE: A SYSTEMATIC REVIEW OF THE LITERATURE.

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Introduction

The extent of reliability of clinical mensuration of the sagittal thoracic spine, e.g., thoracic kyphosis, on radiographs has been debated for years. It is important for health care practitioners to base treatment decisions on both reliable and valid measurement techniques.

Objective (s)

The objective of this study is to identify and review the reliability of different methods of biomechanical analysis of the sagittal thoracic spine on radiographs that are commonly used in clinical practice.

Study Design

Systematic review of the literature

Methods

This review was conducted using the Peer Review of Electronic Search Strategies (PRESS) checklist to organize the search strategy. A combined approach using Medical Search Headings (MeSH) search terms and a SROL search strategy was used. Our review followed the recommendations of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Databases to be searched include PubMed, Cinahl, AltHealth Watch, Web of Science, and a grey literature search.

Results

Initial search results produced 978 results. 658 records were screened by two independent reviews. 187 full text articles were retrieved. 55 studies were included in the final analysis and were independently assessed by two of the authors for methodological quality using the 11-item Quality Appraisal of Diagnostic Reliability (QAREL) tool for reliability studies. 13 studies were of low methodological quality (high risk of bias), while 14 were of high quality (low risk of methodological bias and 28 were of moderate quality with a moderate risk of methodological quality. 54/55 of the studies reported good to excellent reliability of the method being investigated.

Conclusion and significance

Based on the results of this systematic review of the literature the vast majority of articles investigating the reliability of common methods quantifying sagittal thoracic spine alignment on radiographs show good to excellent reliability.

Poster 45

NOVEL SURFACE TOPOGRAPHIC ASSESSMENT OF LUNG VOLUME IN PEDIATRIC SPINAL DEFORMITY PATIENTS

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Introduction

Severe spinal deformity is associated with restrictive pulmonary disease, secondary to chest wall distortion and limitations in lung volume. Traditional pulmonary function tests (PFTs) like spirometry and body plethysmography, although gold standards, have limitations such as patient discomfort and require patient cooperation.

Objective (s)

This study explores the utility of Surface Topographic (ST) scanning as an alternative protocol, specifically investigating if ST measurements of body volume difference (BVD) between maximum inhalation and exhalation correlate with key pulmonary metrics like forced vital capacity (FVC), vital capacity (VC), total lung capacity (TLC), residual volume (RV), and forced expiratory volume (FEV1).

Study Design

Retrospective review of a prospective registry cohort.

Methods

This retrospective study analyzed pediatric patients aged 10-18 years with spinal deformities and thoracic or thoracolumbar curves of ≥40˚. Patients with prior chest or spine surgery or with Scheuermann's kyphosis were excluded. All patients received ST scans, standard clinical evaluations, and EOS radiographs, along with PFTs within three months of imaging. The ST scans calculated BVD as the difference in total body volume between maximal inhalation and exhalation. Linear regression was used to evaluate the relationship between BVD, standard PFT values, as well as the magnitude of spinal (thoracic and thoracolumbar) curves.

Results

The study included 18 patients (average age 14.4 ± 2.2 years, BMI 21.4 ± 4.5 kg/m², 72.2% female) with a mean thoracic/thoracolumbar curve of 61.5˚ ± 13.9˚ (45.1˚- 92.6˚). Sixteen patients had idiopathic scoliosis, one had neuromuscular scoliosis, and one had thoracogenic scoliosis. Strong correlations were found between BVD and FVC ($R = 0.874$, $p < 0.0001$), VC ($R = 0.831$, $p < 0.0001$), and TLC ($R = 0.768$, p <

0.0001). No significant correlations were identified between the Cobb angle and either ST BVD measurements or PFT values.

Table 1: Correlations between BVD and thoracic/thoracolumbar curve with PFT values.

	Body Volume Difference (L)			
	R	R^2	P-value	RMSE
FVC (L)	0.874	0.764	< 0.0001*	0.444
VC (L)	0.831	0.690	< 0.0001*	0.492
TLC (L)	0.768	0.589	< 0.0001*	0.670
RV (L)	0.191	0.037	0.462	0.348
FEV1 (L)	0.886	0.785	< 0.0001*	0.359

*Significant at p <0.05

Figure 1: ST BVD (L) vs. VC (L) and FVC (L).

Conclusion and significance

ST scanning offers a novel and less intrusive approach to evaluating lung volumes, potentially avoiding formal PFTs and/or CT scans and saving time and frustration for both healthcare providers and patients. The strong positive correlations between ST BVD measurements and FVC, VC, and TLC suggest that ST scanning may be a viable method for assessing pulmonary volumes in pediatric patients with significant spinal deformities. As a rapid, non-contact and reproducible method, ST scanning may be particularly useful for patients who are unable to undergo traditional PFTs. Future research with a larger and more diverse patient population is in progress to validate these findings.

Poster 46

NON-STEROIDAL ANTI-INFLAMMATORY DRUG USE AND SERIOUS ADVERSE GASTROINTESTINAL OUTCOMES IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS WHO HAVE A CLINICALLY ACTIONABLE GENE-DRUG INTERACTION VIA A CYP2C9 REDUCED METABOLIZER PHENOTYPE

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Introduction

The spinal curvature observed in adolescent idiopathic scoliosis (AIS) often translates to chronic and/or acute back pain in these patients. Nonsteroidal anti-inflammatory drugs (NSAIDs) are often used for this pain. The Clinical Pharmacogenetics Implementation Consortium (CPIC) guidelines provide actionable recommendations for CYP2C9 poor and/or intermediate metabolizers with an activity score of 1.0, depending on the drug, for the NSAIDs celecoxib, ibuprofen, flurbiprofen, meloxicam, and piroxicam. To our knowledge, there are no studies describing CYP2C9 pharmacogenomics testing in patients with AIS who use NSAIDs.

Objective (s)

To determine the proportion of AIS patients taking celecoxib, ibuprofen, flurbiprofen, meloxicam, and piroxicam with an actionable CYP2C9 phenotype result per CPIC guidelines and incidence of a peptic ulcer or gastrointestinal bleed.

Study Design

Case series

Methods

Patients with AIS and CYP2C9 testing were included to analyze use of celecoxib, ibuprofen, flurbiprofen, meloxicam, and piroxicam. CYP2C9 results were categorized into the following three phenotype groupings: poor metabolizer, intermediate metabolizer with an activity score of 1.0, and intermediate metabolizer with an activity score of 1.5 in addition to normal metabolizer. In each of the CYP2C9 phenotype groups, NSAID frequency of use (either scheduled or as needed), total number of patients with each NSAID use, and the outcome of gastrointestinal bleeding or ulceration were collected.

Results

Twenty-one patients with an AIS diagnosis with ages at the time of chart review ranging from 20 to 63 years old had CYP2C9 testing. Twenty-six unique NSAID usages were found amongst these 21 patients. Eighteen of the 21 patients (85.7%) had documented use of celecoxib,

ibuprofen, and meloxicam with seven patients using two or more NSAIDs. No patients used flurbiprofen nor piroxicam. Three patients (14.3%) received celecoxib, with one patient testing as a poor metabolizer. Seventeen patients (81.0%) received ibuprofen, with two patients testing as poor metabolizers. Six patients (28.6%) received meloxicam, with three patients testing as either a poor metabolizer or intermediate metabolizers with an activity score of 1.0. Therefore, there were a total of six patients who had an actionable CYP2C9 result for their NSAID use. One patient had developed a peptic ulcer that was attributed to ibuprofen use. This patient had documented use of ibuprofen 800 mg and was found to be a CYP2C9 intermediate metabolizer with an activity score of 1.0.

Table 1. Summary of percent of patients with unique NSAIDs used for scoliosis symptoms by different CYP2C9 metabolizer phenotypes				
CYP2C9 Phenotype	**Frequency**	**Celecoxib**	**Ibuprofen**	**Meloxicam**
		n = 3 (14.3%)	n = 17 (81.0%)	n = 6 (28.6%)
Poor Metabolizer	PRN	1	1	0
	Scheduled	0	1	0
	Total	1 (4.8%)	2 (9.5%)	0 (0.0%)
Intermediate Metabolizer - Activity Score 1.0	PRN	0	2	1
	Scheduled	2	5	2
	Total	2 (9.5%)	7 (33.3%)	3 (14.3%)
Intermediate Metabolizer - Activity Score 1.5 and Normal Metabolizer	PRN	0	3	0
	Scheduled	0	5	3
	Total	0 (0.0%)	8 (38.1%)	3 (14.3%)

No recorded use of flurbiprofen or piroxicam occurred. Percentage frequencies are displayed with a denominator of 21, representing 26 unique NSAID uses across these 21 patients.

Conclusion and significance

More than a quarter of patients (28.6%) in our cohort were identified to have taken NSAIDs with actionable CYP2C9 gene-drug interactions in which there were recommendations such as using an alternative drug or a reduced dose. One patient developed a peptic ulcer secondary to ibuprofen after using the maximum recommended ibuprofen treatment dose with decreased ability to metabolize ibuprofen due to her CYP2C9 phenotype. Larger studies are needed to determine if CYP2C9 testing can reduce the risk of NSAID adverse effects in patients with AIS. Nonetheless, these results suggest a potential role for pharmacogenomics testing with CYP2C9 in patients with AIS requiring NSAIDs.

Poster 47

MEASUREMENTS OF THE ANGLE OF THE TRUNK ROTATION IN PATIENTS WITH IDIOPATHIC SCOLIOSIS USING A BUNELL SCOLIOMETER, A MOBILE PHONE WITH AN ADAPTIVE OVERLAY AND USING THE TECHNIQUE OF ALIGNING THE PHONE WITH THUMBS - REPEATABILITY AND RELIABILITY OF MEASUREMENT

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Introduction

The most useful clinical test to detect and assess the progression of idiopathic scoliosis is the measurement of the angle of trunk rotation (ATR) using a scoliometer.

Objective (s)

The aim of the study was to compare the ATR measurements using a Bunell scoliometer (BS), a mobile phone with an adaptive overlay (PO) and mobile phone employing the technique of aligning the phone with the thumbs (PT). Additionally, the study aimed to assess the repeatability of measurements within a single researcher and the consistency of measurements between researchers.

Study Design

Prospective diagnostic trials

Methods

The study included 20 girls and 11 boys with adolescent idiopathic scoliosis, aged 14.4±1.53 y.o.

The patients were examined by 2 inexperienced researchers using BS, a mobile phone (Samsung® M21 with the free app spirit level®) with an overlay, printed on 3D printer and a device placed on the thumbs. Patients performed the Adams forward bending test. During the test, the researchers measured ATR in the proximal thoracic (Th prox), thoracic major (Th), lumbar (L) and on the posterior superior iliac spine (PSIS). Measurements were repeated after 1 hour. The results were nanalysed with interclass correlation coefficient ICC.

Results

The measurements revealed excellent reliability between devices at Th and L levels.

The ICC results form measurements preformed with different devices for the spine levels (Th prox/Th/L/PSIS) were as follows: 0.57/0.97/0.97/0.84

The ICC results for measurement performed by two researchers were as follows (Th prox/Th/L/PSIS):
- for the Bunell scoliometer (0.88/0.97/0.97/0.85)
- for a phone with an overlay (0.82/0.95/0.89/0.89)
- for a phone on thumbs (0.66/0.95/0.93/0.91)
The ICC results for repeated measurement performed by one   researcher were as follows (Th prox/Th/L/PSIS):
- for the Bunell scoliometer (0.84/0.98/0.93/0.88)
- for a phone with an overlay (0.82/0.93/0.89/0.93)
- for a phone on thumbs (0.60/0.92/0.94/0.91)

Conclusion and significance

The ATR measurements by inexperienced researchers are highly consistent and repeatable when using both a Bunell scoliometer and a smartphone with an overlay.

In the absence of an overlay, the thumb alignment technique can be employed, though its repeatability and consistency of results are lower in the proximal thoracic spine.

At the thoracic and lumbar level all methods are highly reliable and repeatable.

Poster 48

POSTURAL CONTROL IN ADULT SPINAL DEFORMITY: A SYSTEMATIC REVIEW OF THE LITERATURE

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Introduction

Although an increased understanding of the interrelationships between spinal X-ray parameters has evolved, the assessment of adult spinal deformity (ASD) remains mostly static and falls short of assessing true dynamic functionalities including balance, gait and risk of falling. Functional testing may play a bridging role between static X-ray and patient reported outcomes in the management of ASD patients. Importantly, it is recognized that dynamic functional ability is critical in the assessment of ASD and that objective dynamic and functional assessment are expected to be the future of ASD research. A clinically feasible assessment of dynamic function is the assessment of postural control (standing balance).

Objective (s)

The purpose of this study was to systematically review the literature that has examined postural control in adult spinal deformity (ASD) patients (e.g. scoliosis >20°, sagittal vertical axis >5cm, pelvic tilt >25° and/or thoracic kyphosis >60°). We aimed to ascertain: 1) Whether patients with ASD demonstrate balance deficits; and 2) Which domains of balance are impaired in those with ASD.

Study Design

Systematic review.

Methods

Five databases were used for the literature search: Pubmed, Medline, Scopus, Embase, and CINAHL. Assessment of bias in study design, conduct, and analysis for the located articles was assessed using the Joanna Briggs Institute critical appraisal tools, and a posturography methodological quality assessment scale was used to rate the internal, statistical, and external validity of studies incorporating force plate assessment of standing balance. Inclusion criteria consisted of any balance assessment method used on the population of adults (18+) who had X-ray-diagnosed ASD. We followed PRISMA guidelines and registered this review in PROSPERO.

Results

19 articles were included from 486 articles located in the 5 databases. Study quality was determined to be generally high. Six different types of balance assessments have been utilized. Of 12 studies assessing ASD vs. control participants, the balance evaluation systems test (BESTest), cone of economy (COE),

sensory organization test (SOT) and force plate-derived center-of-pressure (COP) metrics showed statistically different (worse) scores for ASD participants.

Conclusion and significance

There is preliminary evidence that ASD patients have lower BESTest scores, increased sway within the COE, lower equilibrium scores on SOT conditions 5 and 6, as well as greater magnitudes of several force plate-derived COP metrics (e.g. displacement, velocity, area, shear force, left-to-right ground reaction force percentage difference) versus age-matched control participants. Conclusive parameter-specific findings, however, cannot be made due to heterogeneous trial conditions across studies. Future studies are needed and should implement standardized balance testing parameters. Despite the lack of comparability between studies, the preliminary evidence suggests ASD patients display impairments of postural control and it is recommended to include a balance assessment in the routine examination procedures for ASD patients.

Poster 49

SCOLIOSIS, SPINE FUSION, MENTAL HEALTH, BODY IMAGE, AND RESILIENCE – PSYCHOLOGICAL COUNSELING AND THERAPEUTIC ALLIANCE

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Introduction

Scoliosis and spinal fusion patients are at greater risk for developing posttraumatic stress disorder (PTSD) and depression than patients diagnosed with other serious health conditions1. Body image disturbance and distress, associated with scoliosis patients, can also lead to depression and lack of compliance with treatment recommendations, including bracing, and poor post-operative outcomes. Studies indicate that approximately only one-third of spine surgeons utilize pre-surgical psychological assessment2.

Objective (s)

The aim of this study is to examine scoliosis and spinal fusion patients and the associated mental health concerns and psychiatric comorbidities. I utilized web-based recruitment of subjects that have a scoliosis diagnosis. The additional aim is to discover if patients had the mental health support needed to manage their diagnosis and treatment, what type of support they received and if a medical professional recommended psychological support.

Study Design

Methods include an anonymous web survey of 185 adults with a scoliosis diagnosis, 80% of which have had a spine fusion surgery. 10 questions regarding pre and post of mental health and body image.

Methods

Methods include an anonymous web survey of 185 adults with a scoliosis diagnosis, 80% of which have had a spine fusion surgery. 37% of patients were diagnosed under the age of 12, 50% were diagnosed between 12-18 years of age and the remaining respondents were diagnosed over 18 years of age. The survey included questions regarding mental health conditions, body image distress, as well as postoperative psychological changes. I utilize my personal history as a scoliosis patient diagnosed with AIS and braced as an adolescent, experience as a marriage and family therapist, as well as an adult spinal fusion patient.

Results

57% experienced symptoms of depression after scoliosis diagnosis. 80% of adults surveyed stated that they did not feel that they had adequate postoperative mental and emotional support. 20% of spinal fusion patients report symptoms of depression, 16% report symptoms of PTSD and 30% report

symptoms of anxiety. 66% of patients experienced feelings of being different and feeling self-conscious about their appearance after their scoliosis diagnosis and after spinal fusion surgery. 99% of patients reported that their medical team did not refer them to a mental health professional.

Conclusion and significance

There is a clear intersection between mental and physical health and it is important to combine both in the treatment of our patients. There is a higher incidence of psychiatric comorbidities in scoliosis and spinal fusion patients than in the general population. It is the responsibility of mental health professionals and doctors to work together to develop awareness about the signs and symptoms of depression and PTSD and how to address these with our patients. Fostering positivity, support, validation and resilience is key to helping create positive surgical and quality of life outcomes.

Poster 50

SRS-22r RESULTS IN YOUNG ADULT FEMALES PREVIOUSLY CONSERVATIVELY TREATED FOR IDIOPATHIC SCOLIOSIS

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Introduction

Quality of life remains one of the main outcome measures in the treatment of idiopathic scoliosis (IS). Conservatively treated patients are usually never hospitalized and for this reason often lost from follow-up evaluation.

Objective (s)

To assess the quality of life of young adult females who had been under IS conservative treatment during their adolescence.

Study Design

Case series on quality of life at 10 years after conservative scoliosis treatment.

Methods

Thirty adult females, mean age 25.2 years (SD = 3.1), treated at their adolescence for idiopathic scoliosis filled-out the SRSr-22 questionnaire, validated into native language. The IS treatment consisted of TLSO wear and physiotherapeutic specific exercises (N=22) or of physiotherapy alone (N=8). The scoliosis type was: (1) double curve (Lenke 3 or Lenke 6) in 26 patients or (2) single curve (Lenke 1) in 4 patients. The mean follow-up after a full completion of conservative treatment was 10.1 years. The thoracic Cobb angle was 34.4° (SD=13,2) while the lumbar Cobb angle was 28.6° (SD=15,2).

Results

At mean age of 24.8 years (range 20-33), 15 women work while another 15 women continue the education. Two women (a 30-y-o and a 26-y-o) have a child.

The overall SRS-22r score is 4.1 (SD=0.4). The domains scores are as follows: Function = 4.6 (SD=0.4), Pain = 4.1 (SD=0.5), Self-Image = 4.1 (SD=0.7), Mental Health = 3.7 (SD=0.7), Satisfaction = 4.5 (SD=0.6). The Mental Health domain revealed the lowest scores however, the SRS-22r domain questions reveal not specific to scoliosis related issues. The question 11 about the medication for back pain was answered "none" by 25 women and "non-narcotics weekly or less" by the remaining 5 women. The question 22 "would you have the same management again if you have the same condition?" was answered "definitely yes" by 24 women and "probably yes" by the remaining 6 women.

Conclusion and significance

The highest "Function" domain scores seem to be related to the functional specific physiotherapeutic method applied in these patients. The pain affects 17% but does not interfere with everyday life. The satisfaction from treatment remains high or very high. It is not certain whether the mental health status as assessed with SRS-22r should be attributed to spine deformity or to other causes.

Poster 51

DEVELOPMENT OF A PSYCHOEDUCATIONAL SUPPORT GROUP PROGRAM FOR NEWLY BRACED SCOLIOSIS PATIENTS - A PILOT STUDY

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Introduction

Social support and counseling have been suggested to mitigate the psychological impact of scoliosis and bracing and improve treatment adherence. Psychoeducation, a strategic method of providing information, resources, and coping skills, is often used by mental health providers during counseling. A combination of psychoeducation and social support has not been previously studied in the scoliosis population.

Objective (s)

The purpose of this study was to develop a psychoeducational support group program for adolescents receiving a scoliosis brace and to assess the program's feasibility and efficacy.

Study Design

The pilot study design is a prospective longitudinal study.

Methods

Participants were adolescents between ages 10 and 17, had an idiopathic scoliosis diagnosis, and were receiving a brace for the first time. A series of four online group-based psychoeducational sessions was conducted with three cohorts of participants. Topics covered included building community, fostering a strong sense of self, managing emotions, and coping with stress. The sessions were led by doctoral clinical psychology students who were supervised by a clinical psychologist. The study protocol is outlined in Figure 1. Descriptive statistics, Friedman's test, and Wilcoxon signed-rank test were used to analyze responses.

Results

Ten participants completed the program. One was excluded from data analysis due to incomplete survey responses. Median age of participants was 11 (IQR: 2), and 8 were female. Group size ranged from 3-4 participants. Survey responses from all three data collection time points were compared using Friedman's test, and no significant differences were found. Eight participants found the sessions to be helpful or very helpful, and 8 reported that participating in a program like this is important or very important for someone new to bracing. Eight participants reported that they plan to use the strategies they learned to adhere to their prescribed brace treatment, and 8 were confident in their ability to make these changes.

Nine female parents completed the caregiver survey before the first and after the fourth session. One mother also had a scoliosis diagnosis. Although the decrease did not achieve statistical significance, absolute levels of parental perception of child stress were lower following the sessions (z = -1.77, p = .077), as were perceptions of brace-related emotional outbursts (z = -1.63, p = .102). Brace-related parental stress also trended downward (z = -1.41, p = .157). All parents reported that they would recommend a program like this to a parent of a newly braced child.

Conclusion and significance

This innovative psychoeducational support group program was well-received by the participating adolescents and their parents. Participants found the program helpful and reported confidence in their ability to adhere to treatment. Future research can further explore the impact of this program using a larger sample.

Poster 52

CHARACTERISTICS OF PAIN IN ADULT SPINAL DEFORMITY

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Introduction

Adults with idiopathic scoliosis (IS) have a minimal risk of rapid curve progression, therefore treatment is not as accessible to this cohort compared with adolescent patients. Pain is a commonly-reported characteristic of patients with IS.

Objective (s)

To determine the prevalence and characteristics of pain in a large cohort of adult patients with idiopathic scoliosis (IS).

Study Design

Retrospective cohort design.

Methods

Subjective pain assessment notes were analysed for consecutive adult IS patients who underwent an initial assessment between April 2019 and April 2022.

Results

258 patients with a mean age of 35.8 were included. 1 pain was reported in 82% of patients, 2 pains in 31% and 3 or more pains in 8%. Lumbar pain was the most common (43%) followed by thoracic pain (33%).

 Of the patients with lumbar pain, 78% had lumbar/thoracolumbar- and 12% had thoracic-curvatures. Of the patients who reported thoracic pain, 77% had thoracic- and 23% had lumbar/thoracolumbar-curvatures.

Of the 214 patients with lumbar/thoracolumbar curvatures, 56% reported lumbar pain. Of these, 53% reported pain over the convex- and 29% reported pain over the concave-aspects of the curvature. 17% of patients reported central or bilateral pain and 3% did not detail the side of their pain.

Of the 181 patients with thoracic curvatures, 36% reported thoracic pain. Of these, 74% reported pain over the convex- and 12% reported pain over the concave-aspects of the curvature. 12% reported central or bilateral pain and 2% did not detail the side of their pain.

Conclusion and significance

Pain is prevalent in patients with IS with over 80% of patients reporting a minimum of 1 pain. These results highlight the need for pain management in adults with IS. The majority of pain was present in the muscle around the convex aspect of the curvature(s). This could substantiate the need for Physiotherapy Scoliosis Specific Exercise (PSSE) in this cohort. Further research is recommended to investigate PSSE treatment effects on pain around the convex aspect of the curvature(s).

Poster 53

RANGE OF MOTION ANALYSIS AND OUTCOME MEASURES FOLLOWING POSTERIOR DYNAMIC DEFORMITY CORRECTION (PDDC) SURGERY AND REHABILITATION

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Introduction

PDDC surgery uses an expandable rod that attaches to the concavity of the spine that can be used to treat patients with adolescent idiopathic scoliosis (AIS).

Objective (s)

The objective of this study is to determine how PDDC affects the curve magnitude, range of motion, strength, rehabilitation and quality of life for patients with AIS.

Study Design

Patients with AIS treated with a PDDC surgery were consecutively enrolled and included in this report. Inclusion criteria: Lenke 1/ Lenke 5 patients with major Cobb angle of 35°-60° that reduces ≤30° on standing lateral bending. A novel approach of utilizing the Gait and Motion analysis lab to study pre and post-operative spinal range of motion and kinematics was utilized. Following surgery, patients received 6-12 physical therapy visits utilizing a Scolio-Pilates method.

Methods

During a pre-operative and 1-year post appointment, patients completed a range of motion assessment using motion capture technology. At these appointments, strength was assessed by a physical therapist, radiographic imaging of the spine was taken, and the patient completed a health-related quality of life measured (SRS-30).

Results

Data is included for 20 patients: 14 patients were classified as Lenke 1 and 6 patients as Lenke 5 curves. Preoperative X-rays showed the mean major Cobb angle was 46.2°±5.9°. The scoliosis was corrected to a mean of 17.0°±6.6° at one-year, with a 15% revision rate.

From the motion capture, torso flexion (relative to pelvis) was preserved, initial mean of 43.4° before surgery and 44.5° 1 year after surgery. Pre-operative lateral bending into the curve convexity was 38.2°, and 36.3° post-operatively. Lateral bending into the concavity of the curve was reduced from 40.8° to 34.4°. Total rotation was slightly minimized, starting at 84.5° and 75.4° after.

SRS-30 mean scores improved from 4.02±0.48 to 4.08±0.47.

95% of patients reported no pain at time of physical therapy discharge. Strength of the abdominals, paraspinals, and gluteals were increased or preserved in 94% of patients. Of the patients participating in sports (15), 100% successfully returned to play. The average time to return to sport was 14.07±7.14 weeks.

Conclusion and significance

PDDC surgery and rehabilitation demonstrates promising radiographic results, a modest rate of revision surgery, preserved range of motion, improved SRS-30 scores, reduced pain, and preservation of strength.

The PDDC system stabilizes the scoliotic deformity without the need for a spinal fusion. This is the only study to use motion capture technology to assess kinematics following PDDC.

Poster 54

ISYQOL-PL QUALITY OF LIFE OF ADOLESCENTS TREATED WITH A BRACE FOR IDIOPATHIC SCOLIOSIS

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Introduction

Brace treatment can impact the quality of life (QoL) of adolescents with idiopathic scoliosis (IS). ISYQOL-PL - Italian Spine Youth Quality of Life questionnaire is a tool helpful in assessing the impact of brace treatment on the patient's quality of life.

Objective (s)

To assess the impact of bracing on the QoL of adolescents with IS using the ISYQOL-PL questionnaire.

Study Design

A cross-sectional study.

Methods

Seventy-eight IS patients (48 undergoing brace treatment) aged 10-17 were enrolled. All patients fulfilled the ISYQOL-PL questionnaire once. The study group was analyzed as follows: (1) braced versus non-braced patients; (2) compliant (wore a brace as recommended) versus non-compliant patients; (3) brace treatment duration of less than 6 months versus more than 6 months.

Results

A moderate negative correlation of the recommended brace-wear time versus ISYQOL-PL score and of the difference between the recommended and the actual brace-wear time versus the ISYQOL-PL score was found, r= - 0.357, p < 0.05; r= - 0.332, p < 0.05, respectively.

No significant correlation between the ISYQOL-PL score versus the actual brace-wear time was found (r = - 0.166, p > 0.05). Also, no significant correlation between the ISYQOL-PL score versus the duration of the brace treatment, for both groups - treated < 6 months and > 6 months was found, r= 0.207, p > 0.05; r= 0.205, p > 0.05, respectively.

Conclusion and significance

Poor compliance with brace-wear recommendation, as well as the time of brace-wear recommendation, were related to lower QoL in adolescent patients with IS.

Poster 55

IDENTIFYING THE PROGNOSTIC FACTORS OF QUALITY-OF-LIFE TREATMENT OUTCOMES FOR BRACE-ONLY OR SPECIFIC EXERCISE-ONLY TREATMENTS FOR ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS

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Introduction

Positive effects with bracing or exercise treatments have been shown for management of adolescent idiopathic scoliosis (AIS); yet predictors of treatment outcomes for either treatment used alone are still uncertain. Literature has mostly reported on predicting changes in the curve severity over time, whereas scoliosis could also impact quality of life and perceived appearance.

Objective (s)

This systematic review aimed to identify predictors of patient-related outcome measurements (PROMs) for adolescents with IS treated with specific brace-only or specific exercise-only.

Study Design

Systematic review.

Methods

Four databases including MEDLINE, EMBASE, Web of Science, and CINAHL were searched using terms identifying AIS, prognostic factors, interventions, and outcomes. The search strategy was tailored for each database. Pairs from eight independent reviewers were involved in screening abstracts and full-texts and extracted data. The Quality in Prognostic Studies (QUIPS) tool was used to assess the risk of bias. Strength of evidence summary statements were formulated based on the risk of bias and the consistency of the findings.

Results

A total of 2224 articles were acquired after removing duplicate articles. Seven articles predicted outcomes of brace-only treatment and no study was found on specific exercise-only. The predictive factors of PROMS for brace treatment included: longer treatment period predicted better long-term SRS-22 total score with limited strength of evidence from one study. For other predictors, the level of evidence was unclear. Predictors of long-term outcomes (> 1-year), each from 1 study, were: a) larger Cobb angle predicted worse Spinal Appearance Questionnaire (SAQ) chest scores and worse depression,

b) higher age predicted better SAQ curve scores, c) larger apical translations predicted worse SAQ shoulders and chest scores; d) a passive introverted personality or an active outgoing Maudsley Personality Inventory character type predicted worse SRS-22 treatment satisfaction, e) higher BMI predicted better SAQ curve, Rolland-Morris questionnaire lumbosacral pain, Quebec Back Pain Disability Scale (QDS) moving scores and worse SRS-22 Total, f) larger vital capacity predicted better QDS score, g) longer total bracing duration predicted worse depression, h) negative parental attitudes predicted worse depression, i) higher Strengths and Difficulties Questionnaire emotional symptoms, peer problems, prosocial behavior, and total scores predicted worse depression.

Poor brace adherence from one study with short-term follow-up predicted worse change of brace questionnaire (BRQ) for health perception, pain, physical and emotional functioning, and total scores.

Conclusion and significance

No study predicted PROMS for exercise only treatment. Eleven parameters predicted bracing PROMs, but most presented moderate risk of bias. The longer treatment time presented limited strength of evidence. Since most findings still present an unclear strength of evidence, common weaknesses are identified, and the results lead to encouraging more high-quality studies on predicting bracing outcomes. Prediction of the outcome is clinically valuable for orthotists or physiotherapists as they can use this information to optimize the treatment plans for more effective treatment outcomes.

Poster 56

IDENTIFYING PROGNOSTIC FACTORS OF PATIENT RELATED OUTCOMES MEASUREMENTS IN QUALITY-OF-LIFE FOR AN INTEGRATED BRACE AND SPECIFIC EXERCISE TREATMENT FOR ADOLESCENTS WITH IDIOPATHIC SCOLIOSIS

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Introduction

Bracing and specific exercises are the two most used conservative treatments for children with adolescent idiopathic scoliosis (AIS). It is not clear which candidates would benefit most from applying combined bracing and specific exercise management. There is no accurate prediction model available to guide orthotists and physiotherapists to predict the quality-of-life treatment outcomes for the combined treatment.

Objective (s)

This systematic review aimed to identify predictors of patient-related outcome measurements (PROMs) in quality-of-life for children with AIS who receive both bracing and specific exercise at the same time.

Study Design

A systematic review.

Methods

Four databases including MEDLINE, EMBASE, Web of Science, and CINAHL were searched using terms identifying IS, potential prognostic factors, interventions, and quality-of-life outcomes. Pairs from eight independent reviewers conducted abstracts and full-texts screening, and data extraction. The Quality in Prognostic Studies (QUIPS) tool was used to assess the risk of bias of studies. Strength of evidence summary statements were formulated based on the risk of bias and the consistency of the findings. The prediction interval was ≤1-year for short-term and >1-year for long-term predictions. Figure 1 shows the PRISMA study selection flowchart.

Figure 1. The PRSIMA flow chart

Identification

MEDLINE
(n=491)

EMBASE
(n=1339)

Web of Science
(n=914)

CINAHL
(n=425)

Screening

Records after duplicates removed
(n=2224)

Records included for abstract
screening
(n=2224)

Abstracts excluded after screening:
(n=1740)

Eligibility

Full-text articles assessed for
eligibility
(n=484)

Full-text articles excluded: (n=397)
- No prediction: 247
- Brace only treatment: 85
- Sample size <10, grey literature cross-sectional study: 57
- Non-IS: 28
- No report of outcome: 24
- Non-rigid brace: 11
- No intervention/follow-up/natural history: 10
- No scoliosis specific exercise: 9
- Mean±SD follow interval <4 months for brace and <6 weeks for exercise: 4
- Non-radiographic imaging method: 2
- Previous brace treatment: 2
- Non-English paper: 2
- Using specialized parameter for prediction: 1

Included

Studies included in qualitative
synthesis
(n=2)

Results

Two studies were found on prediction of PROMs when combining bracing and specific exercises**.** For short-term prediction: Unclear evidence from 1 study found that Schroth curve classification (type 3C) predicted better Scoliosis Research Society (SRS-22r) (function), and higher age predicted worse SRS-22r (total) scores. Unclear evidence from 1 study found that Schroth curve classification (3C) predicted better Spinal Appearance Questionnaire (SAQ) scores (prominence, trunk shift and curve), higher self-efficacy scores predicted better SAQ (waist) and wearing brace versus not predicted better SAQ general scores. Unclear evidence from 1 study found that patients with lower age and higher height predicted a better SAQ trunk shift score. Wearing a brace versus did not show worse SAQ waist scores.

For the long-term prediction: Unclear evidence found that higher age and larger curve severity predicted worse Psychological General Well-being and Self-perception scores, respectively. Higher age, larger curve severity, and presence of sagittal imbalance predicted worse back pain. Any translatory shifts predicted worse leg pain. Larger severity predicted deteriorated Oswestry Disability Index and Hannover Functional Questionnaire (HFAQ). Any translatory shift predicted worse HFAQ. Curves >45° compared to smaller curves predicted worse health-related-quality-of-life (WHOQOL-100) (physical domain) scores.

Conclusion and significance

The two most common predictive factors for PROMs were curve severity and age. The level of evidence is mostly unclear which demands more high-quality prediction studies that report treatment outcomes based on the combined brace and specific exercise interventions. Six predictors of short-term outcomes and 4 of long-term outcomes were identified to help selecting patients with the best response to integrating both brace and specific exercise as recommended by the SOSORT.

Poster 57

THE PSYCHOLOGICAL APPROACH OF THE JI METHOD: THE IMPORTANCE OF ENGAGEMENT AND STABILITY IN TREATING SCOLIOSIS"

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Introduction

In treating scoliosis, psychological stability and patient engagement are as crucial as physical factors. The imbalance in the sympathetic/parasympathetic nervous system, muscular imbalances, and especially the emotional fluctuations in adolescents significantly impact the treatment process. The Ji Method focuses on creating an environment where patients can actively engage and experience positive psychological effects during exercise.

Objective (s)

The aim of this study is to assess how the Ji Method enhances psychological stability and exercise engagement in scoliosis patients, and to evaluate its effectiveness.

Study Design

This prospective case study involved 60 scoliosis patients. Participants engaged in the Ji Method program, which emphasized creating an environment conducive to psychological stability.

Methods

Participants attended the Ji Method program three times a week for 12 weeks. The program integrated elements (such as lighting, African drum music) to enhance a sense of calm. Psychological stability and exercise engagement were evaluated through surveys and mental concentration measurements.

Results

Participants reported an average increase of 50% in psychological stability and 55% in exercise engagement ($p<0.01$). Additionally, over 85% of participants reported positive emotional responses post-exercise.

Conclusion and significance

The Ji Method is effective in enhancing psychological stability and exercise engagement in scoliosis patients. This approach encourages patients to experience positive hormonal responses during exercise and promotes continuous participation in treatment. This study underscores the importance of psychological elements in scoliosis treatment and can significantly contribute to the development of future treatment methodologies.

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